10-02-06

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Sheldon	§	Atty. Dkt. No.: COS-819
	§	
Serial No.: 10/713,811	§	Group Art Unit: 1733
	§	
Confirmation No.: 2575	§	Cust. No.: 25264
	§	
Filed: November 14, 2003	§	Examiner: Zacharia
	§	
For: High Tenacity and Toughness in Metallocene Polypropylene Films	§	
	§	
	§	
	§	

Mail Stop Appeal Brief-Patents
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TRANSMITTAL LETTER

In connection with the above identified application, Applicants respectfully resubmit the following in response to a conversation with Ms. Jones of the USPTO on September 27, 2006:

1. Appeal Brief.

Respectfully submitted,

[signature]

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APPEAL BRIEF

Appellants submit this Appeal Brief to the Board of Patent Appeals and Interferences on appeal from the decision of the Examiner of Group Art Unit 1733 dated April 21, 2006, finally rejecting claims 1-2, 4-5, 9-20 and 26-27.

Real Party in Interest

The present application has been assigned to Fina Technology Inc., P.O. Box 674412, Houston, Texas 77267.

Related Appeals and Interferences

Appellants assert that no other appeals, interferences or judicial proceedings are known to the Appellants, the Appellants' legal representative or Assignee that will

directly affect, be directly affected by or have a bearing on the Board's decision in the pending appeal.

Status of Claims

Claims 1-2, 4-5, 9-20 and 26-27 are pending in the application and were originally presented in the application. Claim 16 stands rejected under 35 U.S.C. §112, second paragraph. Claims 1-2, 4-5, 9-14, 17-20 and 26-27 stand rejected under 35 U.S.C. §102(e) and claims 1-2, 4-5, 9-20 and 26-27 stand rejected under 35 U.S.C. §103(a). The §102 and §103 rejections of claims 1-2, 4-5, 9-20, 17-20 and 26-27 are appealed, while the §112 rejection of claim 16 is not appealed. The appealed claims are shown in the attached Appendix A.

Status of Amendments

No amendments have been made to the pending claims in response to the Final Office Action.

Summary of Claimed Subject Matter

Independent claim 1 recites woven products formed from a slit film product. The slit film product includes a metallocene catalyzed polypropylene and exhibits a tenacity of at least about 2.5 g/den. In addition, the film product is capable of being drawn at a draw ratio of from about 5.0:1 to about 10.0:1 and the woven product exhibits a tenacity of within about 10.0 percent of the tenacity of the slit film. The slit film substantially retains its strength and toughness properties after being subjected to stressful end-use processing, such as weaving. For example, the formed woven article has a tenacity of within about 10.0 percent of the tenacity of the slit film. In addition, the formed slit film unexpectedly retains a higher percentage of the film product tenacity than Ziegler-Natta polypropylene. *See*, *Id.* (inventive woven article exhibited 4% drop in tenacity after weaving, while the Z-N woven article exhibited 42% drop.)

Independent claim 13 recites a woven article formed from a film product of a process. The process includes polymerizing a monomer in the presence of a metallocene catalyst system to produce metallocene catalyzed polypropylene. The formed

polypropylene resin is processed to form a film product. The film product is then drawn at a draw ratio of from about 5.0:1 to about 10.0:1. Claim 13 further includes processing the film product into a slit tape product by slitting the film product, resulting in a film having high strength and toughness properties (*e.g.*, a tenacity of at least about 2.5 g/den). *See,* specification, at least paragraph 14, 24, 27 and 38. Claim 13 further includes weaving the slit tape product into a fabric.

Further, dependent claims 9 and 26 recite metallocene catalyzed isotactic polypropylene. *See,* specification, at least paragraph 14.

Grounds of Rejection to be Reviewed on Appeal

1. The rejection of claims 1-2, 4-5, 9-14, 17-20 and 26-27 under 35 U.S.C. §102(b) as being anticipated by *Sheldon.*

2. The rejection of claims 1-2, 4-5, 9-20 and 26-27 under 35 U.S.C. §103(a) as being unpatentable over *Schlecker* in view of *Gownder* or *Saito.*

Arguments

I. THE EXAMINER ERRED IN REJECTING CLAIMS 1-2, 4-5, 9-14, 17-20 AND 26-27 UNDER 35 U.S.C. §102(b) AS BEING ANTICIPATED BY *SHELDON*

Claims 1-14 and 17-27 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Pub. No. 2004/0013870 (*Sheldon.*)

The Examiner states that because *Sheldon* teaches "a woven product formed from a slit film tape . . . having a tenacity of at least about 2.5 g/den, one skilled in the art would expect the tenacity of their woven product to inherently be within about 10.0% of the tenacity of the film product." *See*, Final Office Action at page 3, last paragraph. Appellants strongly disagree. The Examiner's proof of inherency and that one skilled in the art is aware of the property is based on Appellant's own specification. (*See*, Final Office Action at page 3, last paragraph.

The reference must "sufficiently describe the claimed invention to have placed the public in possession of it." *See*, *Minnesota Mining & Mfg. Co. v. Johnson & Johnson Orthopedics, Inc.*, 976 F.2d 1559, 1572, 24 U.S.P.Q.2d 1321, 1332 (Fed. Cir. 1992.) Further, that which is inherent in the prior art, if not known at the time of the invention,

cannot form a proper basis for rejecting the claimed invention as obvious under Section 103. *See, In re Shetty*, 566 F.2d 81, 86, 195 U.S.P.Q. 753, 756-57 (C.C.P.A. 1977.)

Inherent anticipation arises when "the prior art necessarily functions in accordance with, or includes, the claimed limitations" *See, Atlas Powder Co. v. Ireco, Inc.*, 190 F.3d 1342, 1347 (Fed. Cir. 1999). "Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *See, Continental Can Co. USA, Inc., v. Monsanto Co.*, 948 F.2d 1264, 1268-69, 20 U.S.P.Q.2d 1746, 1749 (Fed. Cir. 1991). While Appellants acknowledge that *Sheldon* teaches a slit film, which may be formed from conventional catalysts, the slit film having a tenacity that overlaps the claimed ranges, Appellants submit that the Examiner has not met the burden of proving that a woven article formed from such slit film inherently (always) exhibits a tenacity that is within 10% of the tenacity of the slit film.

The Examiner has not demonstrated that one skilled in the art recognized the metallocene polypropylene films may be capable of producing a lower drop in tenacity during weaving that Ziegler-Natta films. Further, the Examiner has not demonstrated that one skilled in the art recognized the metallocene isotactic polypropylene films may be capable of producing a lower drop in tenacity during weaving that Ziegler-Natta isotactic films, as recited in the dependent claims. To support an anticipation rejection based on inherency, an examiner must provide factual and technical grounds establishing that the inherent feature necessarily flows from the teachings of the prior art. *See, Ex parte Levy*, 17 U.S.P.Q.2d 1464 (Bd. Pat. App. & Int. 1990). The Examiner has not met this burden. The only grounds that the Examiner has used to establish inherency is the Appellants own specification.

Further, Appellants assert that the Examiner is misreading Appellants' specification. Paragraph 14 of Appellants' specification recites a film product. The "film product" is the inventive film product, not just any ipp film product. Therefore, the statement that the typical woven product produced from the film product may comprise a tenacity of within about 10.0 percent of the tenacity of the film product refers to the inventive woven product and not woven products in general.

Therefore, reversal of the rejection is respectfully requested.

II. THE EXAMINER ERRED IN REJECTING CLAIMS 1-2, 4-5, 9-20 AND 26-27 UNDER 35 U.S.C. §103(a) AS BEING UNPATENTABLE OVER *SCHLECKER* IN VIEW OF *GOWNDER* OR *SAITO*

Claims 1-2, 4-5, 9-20 and 26-27 stand rejected under 35 U.S.C. §103(a) as being obvious over U.S. Pat. No. 5,393,598 (*Shlecker*) in view of U.S. Patent Pub. No. 2003/0183975 (*Gownder)* or U.S. Patent No. 6,096,843 (*Saito.*)

The Examiner set forth the same arguments for the §103(a) rejection as the §102(b) rejection. Appellants submit that the Examiner has not presented a prima facie case of obviousness for the same reasons as the Examiner has not demonstrated inherency based on anticipation. Accordingly, Appellants feel that repeating such arguments is unnecessary. Based on such previously presented arguments, Appellants respectfully request reversal of the rejection.

Conclusion

In conclusion, the references of record, either alone or in combination, nowhere teach, show or suggest the features of the pending claims. Thus, Appellants respectfully request reversal of the rejections of the pending claims.

Respectfully submitted,

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Appendix A

Pending Claims

1. A woven product formed from a slit film product comprising:

a metallocene catalyzed polypropylene; and

a tenacity of at least about 2.5 g/den, wherein the film product is capable of being drawn at a draw ratio of from about 5.0:1 to about 10.0:1 and wherein the woven product comprises a tenacity of within about 10.0 percent of the tenacity of the slit film.

2. The film product of claim 1, wherein the film product further comprises a tenacity of about 5.0 g/den.

4. The film product of claim 1, wherein the draw ratio is about 9.25:1.

5. The film product of claim 1, wherein the metallocene catalyzed polypropylene comprises at least one additive.

9. The film product of claim 1, wherein the metallocene catalyzed polypropylene comprises a metallocene catalyzed isotactic polypropylene.

10. The film product of claim 9, wherein the metallocene catalyzed isotactic polypropylene comprises an isotacticity of less than about 99.0 percent.

11. The film product of claim 9, wherein the metallocene catalyzed isotactic polypropylene comprises an insertion error of more than about 2.0 percent.

12. The film product of claim 1, wherein the metallocene catalyzed polypropylene comprises a polymerized propylene.

13. A woven article formed from a film product of a process comprising:

(A) polymerizing a monomer in the presence of a metallocene catalyst system to produce metallocene catalyzed polypropylene, wherein the metallocene catalyst system comprises a metallocene catalyst;

(B) processing the metallocene catalyzed polypropylene into a film product; and

(C) drawing the film product at a draw ratio of from about 5.0:1 to about 10.0:1, the film product comprising a tenacity of at least about 2.5 g/den;

(D) processing the film product into a slit tape product, the processing comprising slitting the film product; and

(E) weaving the slit tape product into a fabric, wherein the fabric comprises a tenacity of within about 10.0 percent of the tenacity of the film product.

14. The film product of claim 13, wherein the monomer comprises a propylene.

15. The film product of claim 13, wherein the metallocene catalyst system comprises a co-catalyst.

16. The film product of claim 13, wherein the co-catalyst comprises an organoaluminum compound.

17. The film product of claim 13, wherein the metallocene catalyst system comprises at least one of a homogenous catalyst system and a supported catalyst system.

18. The film product of claim 13, wherein said polymerizing the monomer is performed in a loop reactor system.

19. The film product of claim 13, wherein said process further comprises

(i) extruding the metallocene catalyzed polypropylene; and

(ii) drawing the metallocene catalyzed polypropylene through a die.

20. The film product of claim 13, wherein said polymerizing the monomer further comprises adding at least one additive.

26. The film product of claim 13, wherein the metallocene catalyzed polypropylene further comprises a metallocene catalyzed isotactic polypropylene.

27. The film product of claim 13, wherein the film product comprises an isotacticity of less than about 99.0 percent.

Appendix B

Evidence

1. *Minnesota Mining & Mfg. Co. v. Johnson & Johnson Orthopedics, Inc.*, 976 F.2d 1559, 24 U.S.P.Q.2d 1321 (Fed. Cir. 1992.)

2. *In re Shetty*, 566 F.2d 81, 195 U.S.P.Q. 753 (C.C.P.A. 1977.)

3. *Atlas Powder Co. v. Ireco, Inc.*, 190 F.3d 1342 (Fed. Cir. 1999).

4. *Continental Can Co. USA, Inc., v. Monsanto Co.*, 948 F.2d 1264 20 U.S.P.Q.2d 1746 (Fed. Cir. 1991).

5. *Ex parte Levy*, 17 U.S.P.Q.2d 1464 (Bd. Pat. App. & Int. 1990).

Appendix C

Related Proceedings

Not Applicable

Page 1264
948 F.2d 1264
20 U.S.P.Q.2d 1746

CONTINENTAL CAN COMPANY USA, INC. and Continental Pet Technologies, Inc., Plaintiffs-Appellants,

v.

MONSANTO COMPANY, Hoover Universal, Inc. and Johnson Controls, Inc., Defendants-Appellees.

No. 90-1328.
United States Court of Appeals, Federal Circuit.
Nov. 13, 1991.
Rehearing Denied Dec. 26, 1991.

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Eugene F. Friedman, Eugene F. Friedman, Ltd., Chicago, Ill., argued for plaintiffs-appellants. With him on the brief were Edwin C. Thomas, III and David M. Novak, Bell, Boyd & Lloyd, Chicago, Ill. Also on the brief was Kurt L. Grossman, Wood, Herron & Evans, Cincinnati, Ohio.

Henry J. Renk, Fitzpatrick, Cella, Harper & Scinto, of New York City, argued for defendants-appellees. With him on the brief were Lawrence F. Scinto and Bruce C. Haas. Also on the brief were Jacob K. Stein, Deborah DeLong, Thompson, Hine & Flory, Cincinnati, Ohio, Lawrence L. Limpus, Monsanto Co., St. Louis, Mo. and Edward L. Levine, Johnson Controls, Inc., Milwaukee, Wis.

Before NEWMAN, ARCHER, and RADER, Circuit Judges.

PAULINE NEWMAN, Circuit Judge.

Continental Can Company USA and Continental PET Technologies (collectively "Continental") appeal the partial summary judgment of the United States District Court for the Southern District of Ohio, holding that United States Patent No. 4,108,324 (the Conobase or '324 patent) is invalid. 1 Final judgment was entered on this issue, for the purpose of appeal.

Summary Judgment

An issue may be decided on motion for summary judgment when there is no genuine issue of material fact, and the movant is entitled to judgment as a matter of law. Fed.R.Civ.P. 56(c); Anderson v. Liberty Lobby, Inc., 477 U.S. 242, 106 S.Ct. 2505, 91 L.Ed.2d 202 (1986); Celotex Corp. v. Catrett, 477 U.S. 317, 325-26, 106 S.Ct. 2548, 2554, 91 L.Ed.2d 265 (1986); Scripps Clinic & Research Foundation v. Genentech, Inc., 927 F.2d 1565, 1571, 18 U.S.P.Q.2d 1001, 1005 (Fed.Cir.1991). The movant's burden is to show that no fact material to the issue is in dispute, that even if all material factual inferences are drawn in favor of the non-movant the movant is entitled to judgment as a matter of law. Id. Summary judgment is as available in patent cases as in other areas of litigation. Chore-Time Equipment, Inc. v. Cumberland Corp., 713 F.2d 774, 778-79, 218 U.S.P.Q. 673, 675. (Fed.Cir.1983)

The purpose of the summary process is to avoid a clearly unnecessary trial, Matsushita Elec. Industrial Co. v. Zenith Radio Corp., 475 U.S. 574, 587, 106 S.Ct. 1348, 1356, 89 L.Ed.2d 538 (1986); it is not designed to substitute lawyers' advocacy for evidence, or affidavits for examination before the fact-finder, when there is a genuine issue for trial. As stated in Adickes v. S.H. Kress & Co., 398 U.S. 144, 176, 90 S.Ct. 1598, 1618, 26 L.Ed.2d 142 (1970) (Black, J., concurring), "[t]he right to confront, cross-examine and impeach adverse witnesses is one of the most fundamental rights sought to be

preserved by the Seventh Amendment". See also Poller v. Columbia Broadcasting System, Inc., 368 U.S. 464, 473, 82 S.Ct. 486, 491, 7 L.Ed.2d 458 (1962).

While facilitating the disposition of legally meritless suits, when summary judgment

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is improvidently granted the effect is to prolong litigation and increase its burdens. This is of particular concern in patent disputes, where the patent property is a wasting asset, and justice is ill served by delay in final resolution. In the case at bar, although some issues could be resolved on the law and undisputed facts, other issues require trial.

The Patented Invention

The '324 patent, entitled "Ribbed Bottom Structure for Plastic Container", inventors Suppayan M. Krishnakumar, Siegfried S. Roy, John F.E. Pocock, Salil K. Das, and Gautam K. Mahajan, is directed to a plastic bottle whose bottom structure has sufficient flexibility to impart improved impact resistance, combined with sufficient rigidity to resist deformation under internal pressure. The patented bottle is said to provide a superior combination of these properties. The bottom structure is illustrated as follows:

NOTE: OPINION CONTAINS TABLE OR OTHER DATA THAT IS NOT VIEWABLE

Claim 1 is the broadest claim of the '324 patent:

1. A container having a sidewall and a bottom structure closing the container at an end portion of the sidewall,

the outer surface of the bottom structure comprising a central concavity,

a convex heel surrounding the concavity and merging therewith and with the sidewall end portion, the lowermost points of the heel lying in a common plane,

and a plurality of ribs interrupting the outer surface of the concavity and distributed in a symmetrical array,

each rib extending longitudinally in the direction of the heel and downwardly from an inner portion of the concavity, whereby the outer end portion of each rib is lower than the inner end portion thereof,

characterized by the feature that the ribs are hollow.

Claims 2 through 5 include additional limitations, described as contributing to the structure's rigidity, flexibility, or both. Claim 2 specifies the ratios of thickness of the walls of the bottom structure to the thickness of the sidewall end portions. Claim 3 specifies that the margins of each rib merge smoothly with adjacent portions of the bottom structure. Claim 4 specifies that each rib is convex relative to the bottom structure. Claim 5 specifies that each rib is of fusiform (a gently tapered shape at the ends) configuration. Each claim carries an independent presumption of validity,

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35 U.S.C. § 282, and stands or falls independent of the other claims. Altoona Publix Theatres, Inc. v. American Tri-Ergon Corp., 294 U.S. 477, 487, 55 S.Ct. 455, 459, 79 L.Ed. 1005 (1935).

Continental brought suit for patent infringement against Monsanto Company and Monsanto's successor in this business, Hoover Universal, Inc. and Hoover's parent company, Johnson Controls (collectively "Monsanto"). Monsanto moved for partial summary judgment based on issues of validity under 35 U.S.C. §§ 102 and 103.

I

35 U.S.C. § 102(a)

The statutory requirement that a patented invention be "new" is tested in accordance with 35 U.S.C. § 102(a), which provides that:

§ 102. A person shall be entitled to a patent unless--

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent....

The district court found that all the claims of the '324 patent were anticipated by U.S. Patent No. 3,468,443 (the Marcus patent). We conclude that the district court erred in claim interpretation, and also found disputed facts adversely to the nonmovant, thus inappropriately deciding the issue summarily.

Anticipation under § 102(a) requires that the identical invention that is claimed was previously known to others and thus is not new. Scripps Clinic, 927 F.2d at 1576, 18 U.S.P.Q.2d at 1010; Titanium Metals Corp. of Am. v. Banner, 778 F.2d 775, 780, 227 U.S.P.Q. 773, 777-78 (Fed.Cir.1985); Lindemann Maschinenfabrik GmbH v. American Hoist and Derrick Co., 730 F.2d 1452, 1458, 221 U.S.P.Q. 481, 485 (Fed.Cir.1984). When more than one reference is required to establish unpatentability of the claimed invention anticipation under § 102 can not be found, and validity is determined in terms of § 103.

It was Monsanto's burden to show that every element of the several claims of the '324 patent was identically described in the asserted anticipating reference, the Marcus patent. The district court focused on the term "characterized by the feature that the ribs are hollow", which limits all of the '324 patent claims. Continental argues that the district court incorrectly construed this term, as a matter of law, and that the Marcus patent shows ribs that are not hollow, as that term is used in the '324 patent. Continental also points to other differences between the '324 claims and the description in the Marcus patent.

The Marcus patent rib structure is illustrated in Figure 5 and in cross-section in Figure 6:

NOTE: OPINION CONTAINS TABLE OR OTHER DATA THAT IS NOT VIEWABLE

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The Marcus patent does not state that its ribs are "hollow", or use a similar term. Continental's witnesses testified by deposition that the Marcus patent shows solid, not hollow, ribs. A witness (Adomaitis) had stated in an internal memorandum written at Continental in 1969, well before this litigation arose, that "the ribs of their [Marcus'] web can be made of solid beams only." Another witness, '324 co-inventor Pocock, testified that:

It seems evident to me that he [Marcus] was trying to produce some kind of container integrity by the production of essentially solid ribs on the bottom of the bottle. It seems to go to great length here to illustrate them as such.

Krishnakumar, another co-inventor, testified that it "is very obvious the ribs are shown solid", and that Figures 5 and 6 as well as Figures 7 through 12 of the Marcus patent all show solid ribs. However, Marcus, testifying for Monsanto, testified that his ribs were hollow, and that conventional blow molding would inherently produce hollow ribs.

The district court defined "hollow" as meaning that "the inside contour of the ribs generally follows the outside contour thereof", a definition on which the parties agreed. Continental, 11 U.S.P.Q.2d at 1764. See the court's opinion, 11 U.S.P.Q.2d at 1764-68, for various sketches made by the witnesses. Continental states that the district court erred in construing "hollow", and that the phrase

"characterized by the feature that the ribs are hollow" must be construed in terms of the patent in which it appears. See, e.g., Tandon Corp. v. United States Int'l Trade Comm'n, 831 F.2d 1017, 1021, 4 U.S.P.Q.2d 1283, 1286 (Fed.Cir.1987). The '324 patent explicitly distinguished the Marcus patent teachings, stating that the '324 ribs are, unlike Marcus, not filled with plastic. The '324 specification uses the term "hollow", as do the prosecution history and the claims, for this purpose. The '324 patent's usage of "hollow" is illustrated in the rib cross-section in Figure 5A:

NOTE: OPINION CONTAINS TABLE OR OTHER DATA THAT IS NOT VIEWABLE

The Marcus patent's rib structure thus was explicitly differentiated by the term "hollow" as used in the '324 specification, drawings, and prosecution history. Since the claim term must be construed as used by the patentee, the district court erred in its construction of the '324 claim term "hollow". On correct claim construction, the factual question of anticipation must be decided.

Monsanto's argument is that hollow ribs were inherently produced by Marcus. Monsanto thus argues that anticipation lies because the Marcus patent's ribs are "inherently" hollow, regardless of how they are shown in the Marcus patent. Monsanto argues that because the Marcus ribs are formed by injection blow molding, which is the same process described for the Conobase '324 ribs, hollow ribs are inherently disclosed in the Marcus patent.

To serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. In re Oelrich, 666 F.2d 578, 581, 212 U.S.P.Q. 323, 326 (CCPA 1981) (quoting Hansgirg v. Kemmer, 102 F.2d 212, 214, 40 U.S.P.Q. 665, 667 (CCPA 1939)) provides:

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Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. [Citations omitted.] If, however, the disclosure is sufficient to show that the natural result flowing from the operation as taught would result in the performance of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient.

This modest flexibility in the rule that "anticipation" requires that every element of the claims appear in a single reference accommodates situations where the common knowledge of technologists is not recorded in the reference; that is, where technological facts are known to those in the field of the invention, albeit not known to judges. It is not, however, a substitute for determination of patentability in terms of § 103.

Continental does not dispute the applicability of the injection blow molding process. However, Continental disputes the material fact of whether this process necessarily produced "hollow" ribs in the Marcus base structure, as the term "hollow" is used in the '324 patent. Resolution of this disputed fact adversely to Continental was improper on summary judgment. The grant of summary judgment of anticipation under § 102(a) is vacated. The issue requires trial.

II

35 U.S.C. § 102(b)

The district court also held that the Marcus bottle was on sale, 35 U.S.C. § 102(b). Section 102(b) bars entitlement to a patent when:

(b) the invention was ... in public use or on sale in this country, more than one year prior to

the date of the application for patent in the United States....

The Marcus bottle was developed some ten years before the filing date of the '324 patent, during a project wherein Marcus' employer, Admiral Plastics or APL Corporation, entered into agreements with the Coca-Cola Company for the development of a suitable plastic bottle. The agreements provided that Admiral Plastics would make and Coca-Cola would test the bottles, and that if a satisfactory bottle was developed it would be manufactured by Admiral and purchased by Coca-Cola. Minimum commercial quantities and maximum commercial prices were stated in an agreement, and costs were a matter of discussion. Admiral produced a variety of bottle shapes, including the Marcus bottle. The project was terminated after about two years, because the "mechanical performance" requirements were not met, as Coca-Cola wrote at the time.

The district court reasoned that this project "called for the eventual marketing of the Marcus bottles once all technical difficulties were resolved", Continental, 11 U.S.P.Q.2d at 1766, and on this basis held that the Marcus bottles were on sale. This holding was in error, for the "on sale" bar of § 102(b) does not arise simply because the intended customer was participating in development and testing. See Great Northern Corp. v. Davis Core & Pad Co., 782 F.2d 159, 164-65, 228 U.S.P.Q. 356, 358 (Fed.Cir.1986). In Baker Oil Tools, Inc. v. Geo Vann, Inc., 828 F.2d 1558, 1563-65, 4 U.S.P.Q.2d 1210, 1213-15 (Fed.Cir.1987), this court summarized various factors pertinent to the "on sale" bar when there is an issue concerning the relationship between the patentee and the customer: for example, whether there was a need for testing by other than the patentee; the amount of control exercised; the stage of development of the invention; whether payments were made and the basis thereof; whether confidentiality was required; and whether technological changes were made. All of the circumstances attending the relationship must be considered in light of the public policy underlying § 102(b). UMC Electronics Co. v. United States, 816 F.2d 647, 656, 2 U.S.P.Q.2d 1465, 1471-72 (Fed.Cir.1987), cert. denied, 484 U.S. 1025, 108 S.Ct. 748, 98 L.Ed.2d 761 (1988).

The district court acknowledged that all technical difficulties were not resolved and that no sales were ever made.

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Although Admiral Plastics' hope was surely commercial sales, and the record shows that prices and quantities were discussed, this does not of itself place the subject matter "on sale" in the sense of § 102(b). The Marcus bottle was part of a terminated development project that never bore commercial fruit and was cloaked in confidentiality. While the line is not always bright between development and being on sale, see generally UMC Electronics, supra, in this case the line was not crossed. The "on sale" bar is measured by "the time the public came into possession of the invention", id. at 655, 2 U.S.P.Q.2d at 1471 (quoting In re Foster, 343 F.2d 980, 987-88, 145 U.S.P.Q. 166, 173 (CCPA 1965), cert. denied, 383 U.S. 966, 86 S.Ct. 1270, 16 L.Ed.2d 307 (1966) ("What starts the period running is clearly the availability of the invention to the public through the categories of disclosure enumerated in 102(b)...." (emphasis in original))). We conclude that the district court erred in holding that the circumstances that here existed placed the Marcus bottles "on sale" in terms of § 102(b). We therefore reverse and direct that on remand judgment on this issue shall be entered in favor of Continental, as a matter of law.

III

35 U.S.C. § 103

Obviousness, 35 U.S.C. § 103, is reviewed as a legal conclusion based upon underlying facts of four general categories, viz. the scope and content of the prior art, the differences between the prior art and the claimed invention, the level of ordinary skill at the time the

invention was made, and any objective considerations that may be present. Graham v. John Deere Co., 383 U.S. 1, 17, 86 S.Ct. 684, 693-94, 15 L.Ed.2d 545 (1966); Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 1137-38, 227 U.S.P.Q. 543, 547 (Fed.Cir.1985).

The parties agreed that the scope and content of the prior art was adequately represented by four references: the Marcus patent discussed in Part I ante, a patent to Colombo (U.S. Patent No. 3,403,804), and two patents owned by Continental, U.S. Patent No. 3,598,270 (the Petaloid patent), and No. 3,935,955 (the Decaloid patent). They agreed on little else. In granting summary judgment of invalidity for obviousness, the district court found certain disputed material facts and misapplied certain precepts of law. We conclude that the issue was not amenable to summary resolution. Although it is not entirely clear how the references were combined by the court, we shall review the references briefly, in order to explain our conclusion.

The Petaloid Patent

The district court referred to the deposition testimony of Siegfried Roy, one of the co-inventors of the '324 patent, that the Petaloid base, inverted, was similar to the Conobase. Continental points out that neither Roy nor any other deponent suggested that the Petaloid base could be or should be inverted, or that inversion would provide an improved base structure. In In re Gordon, 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed.Cir.1984) this court held that although a prior art device could have been turned upside down, that did not make the modification obvious unless the prior art fairly suggested the desirability of turning the device upside down.

Continental points out that the Petaloid description differs in several other ways from the '324 invention. In the '324 structure the outer end of each rib is lower than the inner end, whereas in the Petaloid structure the outer ends of the ribs are higher than the inner ends; that is, the ribs in the Petaloid base extend upward from the center to the sidewall. The Petaloid bottle is supported on feet extending between the ribs, such feet being the locations for stress concentrations. The following drawing is from the Petaloid patent:

NOTE: OPINION CONTAINS TABLE OR OTHER DATA THAT IS NOT VIEWABLE

Continental states that the '324 Conobase is not only different, but avoids the stress concentrations of the Petaloid device, thus enhancing impact resistance. Monsanto argues that Continental simply used the Petaloid hollow ribs in combination with the Marcus patent. This requires determination of whether there was something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination, in a way that would produce the '324 structure. See, e.g., Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1051, 5 U.S.P.Q.2d 1434, 1438 (Fed.Cir.), cert. denied, 488 U.S. 825, 109 S.Ct. 75, 102 L.Ed.2d 51 (1988). Continental argues that it is not apparent, even with hindsight, how any combination of the Petaloid and Marcus patents or other references lead to the '324 base. The Petaloid patent shows concave ribs that extend all the way to the sidewall, while the Marcus ribs extend "from the heel" toward an annular central ring. The Petaloid base has wide, petal-like, open ribs, while Marcus shows narrow, beam-like ribs. The deposition testimony was in conflict as to the inferences drawn from the references.

On this disputed issue, drawing reasonable inferences in favor of the non-movant, it has not been established that one skilled in the art would be motivated to select and combine features from each source in order to make the '324 base. Interconnect Planning, 774 F.2d at 1143, 227 U.S.P.Q. at 551 ("When prior art references require selective combination by the court to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gleaned from the invention itself").

The Decaloid Patent

The district court also referred to combination of the Decaloid base with the Marcus base. The Decaloid base has ten hollow ribs that extend to the sidewall, and ten feet between the ribs:

NOTE: OPINION CONTAINS TABLE OR OTHER DATA THAT IS NOT VIEWABLE

Monsanto does not explain, and we can not discern, how the combination with Marcus would have led a person of ordinary skill to the '324 base. The court's summary holding of obviousness based on these references, separately or in combination, can not be sustained.

The Colombo Patent

The Colombo base, like the Petaloid and Decaloid bases, has hollow ribs that extend to the sidewall, in a still different structure from that of Marcus and also from that of the '324 patent. Colombo describes his ribs as inverted U-shapes, concave, located on the outer surface of the central concavity:

NOTE: OPINION CONTAINS TABLE OR OTHER DATA THAT IS NOT VIEWABLE

Again, drawing reasonable factual inferences in favor of Continental, and in the absence of any suggestion or motivation in the prior art as a whole to make a selective combination of the Colombo and Marcus

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structures along with other changes needed to obtain the '324 structure, summary judgment of obviousness was inappropriate.

The district court found that there was no substantial difference between the '324 invention and the combined teachings of the prior art:

As obviousness can be established on the basis of the combined teachings of references, we think it is clear that simple enhancements of existing prior art, i.e. inverting the '270 petaloid base, do not constitute a substantial difference between the subject matter claimed in the '324 patent and that of the prior art. Thus, the facts of this case reveal no substantial difference between '324 and the prior art.

Continental, 11 U.S.P.Q.2d at 1769 (citation omitted). However, as we have discussed, the criterion of § 103 is not whether the differences from the prior art are "simple enhancements", but whether it would have been obvious to make the claimed structure.

Objective Indicia

The district court concluded that the structure in suit is simply a variation on known themes. It is in such circumstance that the objective indicia--the so-called secondary considerations--are most useful to the decision-maker. The significance of a new structure is often better measured in the marketplace than in the courtroom.

Thus when differences that may appear technologically minor nonetheless have a practical impact, particularly in a crowded field, the decision-maker must consider the obviousness of the new structure in this light. Such objective indicia as commercial success, or filling an existing need, illuminate the technological and commercial environment of the inventor, and aid in understanding the state of the art at the time the invention was made. See In re Piasecki, 745 F.2d 1468, 1475, 223 U.S.P.Q. 785, 790 (Fed.Cir.1984) (secondary considerations "often establish that an invention appearing to have been obvious in light of the prior art was not" (quoting Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 1538-39, 218 U.S.P.Q. 871, 879 (Fed.Cir.1983))).

Continental licensed the '324 counterpart Japanese patent to a Japanese company, Yoshino, that we are told had been unable to develop a plastic bottle for hot-fill applications. A witness for Toyo Seikan, another Japanese licensee, testified that the Conobase "sustains itself in higher temperatures, and it does not cause buckling after you fill [the bottle]", as compared with previously available plastic bottles. Continental asserts that Monsanto had been unable to develop a satisfactory bottle for hot-fill applications, and had therefore obtained this technology from Yoshino.

The district court acknowledged the commercial success of the Conobase, but stated that "we are not convinced that the conobase alone accounts for any of the success." 11 U.S.P.Q.2d at 1770 (emphasis in original). The court suggested that the commercial success in Japan was due to the market strength of the Japanese licensees, and held that there is no nexus between the merits of the product and its commercial success. It is not necessary, however, that the patented invention be solely responsible for the commercial success, in order for this factor to be given weight appropriate to the evidence, along with other pertinent factors. See generally Demaco Corp. v. F. Von Langsdorff Licensing Ltd., 851 F.2d 1387, 1392-94, 7 U.S.P.Q.2d 1222, 1226-28 (Fed.Cir.), cert. denied, 488 U.S. 956, 109 S.Ct. 395, 102 L.Ed.2d 383 (1988); Rosemount, Inc. v. Beckman Instruments, Inc., 727 F.2d 1540, 1546, 221 U.S.P.Q. 1, 7 (Fed.Cir.1984). Monsanto also states that the Conobase is different from the '324 invention, so that even were the Conobase successful, this does not inure to the benefit of the '324 patent. It is apparent that the factual issues surrounding the objective indicia were disputed, and material.

In view of the material facts requiring resolution, the issue of obviousness was not properly decided on motion for summary judgment. We vacate the grant based on 35 U.S.C. § 103, and remand for trial of this issue and the other issues remaining in the case.

Costs

Costs in favor of Continental.

REVERSED IN PART, VACATED IN PART, and REMANDED.

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1 Continental Can Co. USA v. Monsanto Co., 11 USPQ2d 1761, 1989 WL 136614 (S.D.Ohio 1989), reconsid. denied, No. C-1-86-1213 (S.D.Ohio Nov. 9, 1989).

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190 F.3d 1342 (Fed. Cir. 1999)
ATLAS POWDER COMPANY, Plaintiff, and HANEX PRODUCTS, INC., Plaintiff-Appellant,
v.
IRECO INCORPORATED and ICI EXPLOSIVES USA, INC., Defendants-Appellees.
99-1041
United States Court of Appeals for the Federal Circuit
DECIDED: September 7, 1999

Appealed from: United States District Court for the District of Wyoming

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Chief Judge Alan B. Johnson

Stanford B. Owen, Fabian & Clendenin, of Salt Lake City, Utah, argued for plaintiff-appellant, Hanex Products, Inc. With him on the brief were W. Cullen Battle, Robert A. Garda, Jr., and Jon C. Martinson.

Gordon L. Roberts, Parsons Behle & Latimer, of Salt Lake City, Utah, argued for defendant-appellee, IRECO Incorporated and ICI Explosives USA, Inc. Of counsel on the brief was C. Kevin Speirs.

Before MAYER, Chief Judge, MICHEL and RADER, Circuit Judges.

RADER, Circuit Judge.

The United States District Court for the District of Wyoming determined that U.S. Patent No. 4,111,727 (the Clay patent) and its reissue, U.S. Patent No. RE 33,788 (the reissue patent) were invalid. Atlas Powder Company (Atlas), a licensee under those patents, sued IRECO Incorporated (IRECO) for infringement of the Clay patent. Following two bench trials, the district court concluded that both the original Clay patent and the reissue patent were invalid as anticipated by either U.S. Patent No. 3,161,551 (Egly) or U.K. Patent No. 1,306,546 (Butterworth). Because the district court correctly interpreted the claims and applied the law of anticipation, this court affirms the finding of invalidity.

I.

The Clay patent and its reissue both claim explosive compositions. To detonate,

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explosives require both fuel and oxidizers. The oxidizer rapidly reacts with the fuel to produce expanding gases and heat - an explosion. Composite explosives mix various sources of fuel and oxygen. The most widely used and economical composite explosive is ammonium nitrate and fuel oil (ANFO). ANFO explosives mix about 94% by weight of ammonium nitrate (AN), the oxidizer, with 6% by weight of fuel oil (FO). The AN may include porous prills, dense prills, Stengel flakes, or crystalline AN. ANFO explosives have two primary disadvantages. First, wet conditions dissolve the AN and make the explosive unusable in damp settings. Second, ANFO is a relatively weak explosive because interstitial air occupies considerable space in the mixture, thereby decreasing the amount of explosive material per unit of volume.

To address these shortcomings, explosive experts developed water-in-oil emulsions. These emulsions dissolved the oxidizer into water and then dispersed the solution in oil. Because oil surrounds the oxidizer, it is resistant to moisture, thus solving one of the problems with ANFO. Emulsions also increased the explosive's bulk strength by increasing the density of explosive material in the mixture. Emulsions, however, also have a disadvantage. Emulsions will not

detonate unless sensitized. Sensitivity of a blasting composition refers to the ease of igniting its explosion. Experts generally sensitize emulsions by using gassing agents or adding microballoons throughout the mixture. The gassing agents or microballoons provide tiny gas or air bubbles throughout the mixture. Upon detonation, the gas pockets compress and heat up, thereby igniting the fuel around them. In other words, the tiny gas or air bubbles act as "hot spots" to propagate the explosion.

The Clay patent and its reissue both claim composite explosives made from the combination of an ANFO blasting composition and an unsensitized water-in-oil emulsion. Both patents claim essentially the same blasting composition. Claim one of the reissue patent recites:

1. A blasting composition consisting essentially of 10 to 40% by weight of a greasy water-in-oil emulsion and 60 to 90% of a substantially undissolved particulate solid oxidizer salt constituent, wherein the emulsion comprises about 3 to 15% by weight of water, about 2 to 15% of oil, 70 to 90% of powerful oxidizer salt comprising ammonium nitrate which may include other powerful oxidizer salts, wherein the solid constituent comprises ammonium nitrate and in which sufficient aeration is entrapped to enhance sensitivity to a substantial degree, and wherein the emulsion component is emulsified by inclusion of 0.1 to 5% by weight, based on the total composition, of an [oil-in-water] water-in-oil emulsifier to hold the aqueous content in the disperse or internal phase.

(Underline added.)

When this lawsuit began, Atlas was the exclusive licensee under the Clay patent in the continental U.S. and Hawaii. Atlas commenced this lawsuit against IRECO in 1986, alleging infringement of the Clay patent. During the course of litigation, Dr. Robert Clay, the inventor, filed a reissue petition with the United States Patent and Trademark Office (PTO). Atlas then moved to stay the litigation pending resolution of the reissue application. The district court denied that motion and conducted a first bench trial on the issues of validity and infringement of the Clay patent in October 1986. Dr. Clay then requested suspension of prosecution of the reissue application by the PTO in February 1987. After waiting several years for a decision from the district court, Dr. Clay requested that the PTO reinstate the reissue proceedings in 1990. In January 1992, the Clay reissue patent issued upon surrender of the original patent. Later that

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year, the district court rendered its findings and judgment regarding the validity and infringement of the Clay patent.

In its 1992 judgment, the district court found claims 1, 2, 3, 10, 12, 13, and 14 of the Clay patent invalid as anticipated by either one of two prior art references, Egly or Butterworth. Egly and Butterworth each disclose blasting compositions containing a water-in-oil emulsion and ANFO with ingredients identical to those of the Clay patents in overlapping amounts. The following chart illustrates the overlap between the explosive compositions disclosed in the prior art patents and the Clay reissue patent:

	Egly	Butterworth	Clay
Composition contents:			
Water-in-oil Emulsion	20-67%	30-50%	10-40%
Solid Ammonium Nitrate	60-90% 50-70%	33-80%	
Emulsion contents:			
Ammonium Nitrate	50-70%	65-85%	70-90%

Water	about 3-15%	
about 15-about 35%	7-27%	
Fuel Oil	about 2-15%	
about 5-about 20%	2-27%	
Emulsifier	0.1-5%	
about 1-5%	0.5-15%	

The only element of the Clay patent claims which is arguably not present in the prior art compositions is "sufficient aeration . . . entrapped to enhance sensitivity to a substantial degree." The trial court determined that "sufficient aeration" was an inherent element in the prior art blasting compositions within the overlapping ranges. The district court also found that none of the accused products infringed any of the asserted claims. The 1992 judgment was not final, however, and specifically reserved a decision on the effect of the reissue patent for phase two of the case.

On September 22, 1993, the district court granted Hanex Products Inc.'s (Hanex) motion to intervene in the lawsuit. Hanex owns the two patents and had licensed them to Atlas. Hanex asserted the same claim of patent infringement against IRECO that Atlas had asserted, but also initiated a declaratory judgment action against ICI Explosives USA, Inc. (ICI), Atlas' successor-in-interest, seeking the sole right to control the litigation. In July 1994, the district court granted declaratory relief in favor of Hanex, against ICI, giving Hanex the sole right to control and direct the litigation on the two patents.

After the reissue patent issued, the district court conducted a second bench trial, in January 1996, on the issues of phase two. Specifically, the district court considered whether reissue affected its 1992 judgment. On September 25, 1998, the district court rendered its final judgment finding claims 1, 2, 3, 10, 12, 13, and 14 of the Clay reissue patent invalid as anticipated and finding that IRECO had not infringed any of the asserted claims. Despite the PTO's consideration of the Egly and Butterworth references during prosecution of the reissue, the district court concluded that IRECO had overcome the Clay reissue patent's presumption of validity under 35 U.S.C. § 282 (1994) by clear and convincing evidence. The district court noted that IRECO presented a great deal of testimonial and documentary evidence on inherent disclosures of the prior art that was not before the PTO in the

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reissue proceeding. Hanex appealed to this court from the 1998 final judgment.

II.

This court reviews claim construction as a matter of law. See Cybor Corp. v. FAS Techs., Inc., 138 F.3d 1448, 1451, 46 USPQ2d 1169, 1173 (Fed. Cir. 1998) (en banc); Markman v. Westview Instruments, Inc., 52 F.3d 967, 979, 34 USPQ2d 1321, 1326 (Fed. Cir. 1995) (en banc). Anticipation is a question of fact, including whether or not an element is inherent in the prior art. See In re Schreiber, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997). Therefore, this court reviews a finding of anticipation under the clearly erroneous standard. See Gechter v. Davidson, 116 F.3d 1454, 1457, 43 USPQ2d 1030, 1032 (Fed. Cir. 1997).

"To anticipate a claim, a prior art reference must disclose every limitation of the claimed invention, either explicitly or inherently." In re Schreiber, 128 F.3d at 1477. Anticipation of a patent claim requires a finding that the claim at issue "reads on" a prior art reference. See Titanium Metals Corp. v. Banner, 778 F.2d 775, 781, 227 USPQ 773, 778 (Fed. Cir. 1985). In other words, if granting patent protection on the disputed claim would allow the patentee to exclude the public from practicing the prior art, then that claim is anticipated, regardless of whether it also covers subject matter not in the prior art. See id. at 781. Specifically, when a patent claims a chemical composition in terms of ranges of elements, any single prior art reference that falls within each of the ranges anticipates the claim. See id. at 780-82 ("It is also an

elementary principle of patent law that when, as by a recitation of ranges or otherwise, a claim covers several compositions, the claim is 'anticipated' if one of them is in the prior art."). In chemical compounds, a single prior art species within the patent's claimed genus reads on the generic claim and anticipates. See In re Gosteli, 872 F.2d 1008, 1010, 10 USPQ2d 1614, 1616 (Fed. Cir. 1989).

As noted previously, both Egly and Butterworth disclose blasting compositions with ingredients identical to those of the Clay patent and its reissue in overlapping amounts. The only element which is arguably missing from the prior art is the requirement that "sufficient aeration [be] entrapped to enhance sensitivity to a substantial degree." To decide the issue of anticipation, therefore, the district court examined whether "sufficient aeration . . . to enhance sensitivity" was inherently part of the prior art compositions. That decision, in turn, required the trial court to interpret the claim term "sufficient aeration." By looking at the express language of the claims and the patent's written description, the district court concluded that the claim term "sufficient aeration" included both interstitial air (between oxidizer particles) and porous air (within the pores of oxidizer particles).

The first task of this court on appeal is to construe independently the disputed claim term. This question requires this court to determine whether the claim term "sufficient aeration" includes porous air, as the trial court determined. The claim term "sufficient aeration" does not limit the air content of the composition to interstitial air. Rather, the broad term "aeration" contains no qualitative limits on the kind of air exposure, only the quantitative limit that the air exposure be "sufficient" to enhance sensitivity. If the inventor intended "sufficient aeration" to carry qualitative limits, he also did not express that intention in the patent's written description. The specification gives no explicit definition of the phrase "sufficient aeration . . . to enhance sensitivity," which appears in the patent for the first time in the claims.

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It is, of course, possible that the inventor did not include qualitative limits on the term "sufficient aeration" in the specification because those of ordinary skill in the art understand that only interstitial air enhances sensitivity and satisfies the claim's language. See Autogiro Co. of Am. v. U.S., 384 F.2d 391, 397, 155 USPQ 697 (Ct. Cl. 1967) ("Claims cannot be clear and unambiguous on their face."); Markman, 52 F.3d at 986 ("[T]he focus in construing disputed terms in claim language is . . . on the objective test of what one of ordinary skill in the art at the time of the invention would have understood the term to mean."). The trial record, however, shows that those of ordinary skill in this art at the time the patent application was filed knew that both interstitial and porous air enhance sensitivity. Dr. Clay himself, the inventor of the patents in suit, testified that air from any source would contribute to the explosion of a heavy ANFO composition and, particularly, air trapped within the pores of porous prilled AN. Therefore, this court detects no error in the district court's conclusion that "sufficient aeration . . . to enhance sensitivity" is understood by those of ordinary skill in the art to include both interstitial and porous air. The district court appropriately construed the claims at issue to include aeration from both sources.

III.

Based on its correct interpretation of "sufficient aeration," the district court heard evidence on whether both interstitial and porous air were present and enhanced sensitivity in the prior art explosive compositions. Based on the evidence, the district court concluded that IRECO had shown the inherency of the disputed claim element in the prior art and overcome "the presumption of validity under 35 U.S.C. § 282 by providing clear and convincing evidence of invalidity." This court must determine whether the district court committed clear error by determining that the evidence clearly and convincingly established that "sufficient aeration

. . . to enhance sensitivity" was inherent in either Egly or Butterworth.

To invalidate a patent by anticipation, a prior art reference normally needs to disclose each and every limitation of the claim. See Standard Havens Prods., Inc. v. Gencor Indus., Inc., 953 F.2d 1360, 1369, 21 USPQ2d 1321, 1328 (Fed. Cir. 1991). However, a prior art reference may anticipate when the claim limitation or limitations not expressly found in that reference are nonetheless inherent in it. See id.; Verdegaal Bros., Inc. v. Union Oil Co. of Cal., 814 F.2d 628, 630, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Under the principles of inherency, if the prior art necessarily functions in accordance with, or includes, the claimed limitations, it anticipates. See In re King, 801 F.2d 1324, 1326, 231 USPQ 136, 138 (Fed. Cir. 1986). Inherency is not necessarily coterminous with the knowledge of those of ordinary skill in the art. See Titanium Metals, 778 F.2d at 780. Artisans of ordinary skill may not recognize the inherent characteristics or functioning of the prior art. See id. at 782. However, the discovery of a previously unappreciated property of a prior art composition, or of a scientific explanation for the prior art's functioning, does not render the old composition patentably new to the discoverer. See id. at 782 ("Congress has not seen fit to permit the patenting of an old [composition], known to others . . . , by one who has discovered its . . . useful properties."); Verdegaal Bros., 814 F.2d at 633.

This court's decision in Titanium Metals illustrates these principles. See Titanium Metals, 778 F.2d at 775. In Titanium Metals, the patent applicants sought a patent for a titanium alloy containing various ranges of nickel, molybdenum, iron, and

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titanium. The claims also required that the alloy be "characterized by good corrosion resistance in hot brine environments." Titanium Metals, 778 F.2d at 776. A prior art reference disclosed a titanium alloy falling within the claimed ranges, but did not disclose any corrosion-resistant properties. This court affirmed a decision of the PTO Board of Appeals finding the claimed invention unpatentable as anticipated. This court concluded that the claimed alloy was not novel, noting that "it is immaterial, on the issue of their novelty, what inherent properties the alloys have or whether these applicants discovered certain inherent properties." Id. at 782. This same reasoning holds true when it is not a property, but an ingredient, which is inherently contained in the prior art. The public remains free to make, use, or sell prior art compositions or processes, regardless of whether or not they understand their complete makeup or the underlying scientific principles which allow them to operate. The doctrine of anticipation by inherency, among other doctrines, enforces that basic principle.

The trial record contains exhaustive evidence regarding the inherency of both interstitial and porous air in the Egly and Butterworth compositions within the overlapping ranges. The testimony from expert witnesses for both parties established that whether sufficient air is present in the explosive composition to facilitate detonation is a function of the ratio of the emulsion to the solid constituent. Dr. Clay testified that "if you mix porous prills, for example, with 30% typical water-in-oil emulsions, you're going to have air in there and it will detonate." Another of Atlas' experts testified that a mixture of 30% of either an Egly or a Butterworth emulsion, mixed with 70% standard fertilizer grade porous AN would have interstitial air, assuming nothing was done to disturb the size distribution of the AN prills. The other experts agreed that the emulsions described in both Egly and Butterworth would inevitably and inherently have interstitial air remaining in the mixture up to a ratio of approximately 40% emulsion to 60% solid constituent. The expert testimony supports the district court's conclusion that "sufficient aeration" is inherent in both Egly and Butterworth.

The district court also relied on evidence from several tests which showed that "sufficient

aeration . . . to enhance sensitivity" was inherently present within the overlapping ranges of the Clay patents and Egly and Butterworth. In tests conducted with porous prilled AN combined with FO, stable detonations were obtained in every 8" diameter bore hole test where the percentage of emulsion ranged from 30% to 42.5%. Butterworth specifically discloses the use of porous prilled AN. Butterworth, p. 3, ll. 35-50. These tests, therefore, support the finding that "[t]he emulsions described by Butterworth, combined with the ratios of ANFO disclosed by Butterworth, would inevitably and inherently have interstitial air remaining up to approximately 40% emulsion." The district court also found that the solid AN disclosed in Egly would have included porous prills. These tests, therefore, further support the court's finding that "emulsions described in the Egly Patent, combined with either AN or ANFO, would inevitably and inherently have interstitial air remaining in the mixture up to approximately 40% emulsion to 60% solid constituent." This court discerns no clear error in the district court's conclusion that "sufficient aeration" was inherent in each anticipating prior art reference.

Because "sufficient aeration" was inherent in the prior art, it is irrelevant that the prior art did not recognize the key aspect of Dr. Clay's alleged invention - that air may act as the sole sensitizer of the explosive composition. An inherent structure, composition, or function is not

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necessarily known. See, e.g., In re King, 801 F.2d at 1327; Titanium Metals, 778 F.2d at 782. Once it is recognized that interstitial and porous air were inherent elements of the prior art compositions, the assertion that air may act as a sole sensitizer amounts to no more than a claim to the discovery of an inherent property of the prior art, not the addition of a novel element. Insufficient prior understanding of the inherent properties of a known composition does not defeat a finding of anticipation. See Titanium Metals, 778 F.2d at 782. In addition, there was evidence that Butterworth did recognize the functioning of interstitial and porous air in sensitizing the composition. Butterworth recognizes the need for a gaseous sensitizer. Butterworth, p. 2, ll. 38-56. It teaches that the "sensitizer may be a gaseous sensitizer present in the composition in the form of gas bubbles or discrete particles containing an entrapped gas such as air." Id., p. 2, ll. 41-45. Although this typically suggests use of a gassing agent or microballoons, Butterworth expressly recognizes that in certain ranges (i.e., 50% to 70% by weight of ANFO) the mixture of porous prilled AN and FO alone provides the necessary sensitization. See id., p. 3, ll. 37-50. The district court found that Butterworth thus inherently appreciates that interstitial and porous air may serve as the necessary sensitizer. This court discerns no clear error in that finding.

In reaching this judgment, this court notes that Egly teaches away from air entrapment. Specifically, Egly teaches that it is desirable to "fill all spaces in between each particle to give added density." Egly, col. 1, ll. 26-27. This statement in Egly, however, does not defeat the district court's finding of anticipation for several reasons. First, Egly's teaching does not in any way discredit the trial court's alternative reliance on Butterworth for invalidation of the Clay patent and its reissue. More important, the statement in Egly is, in fact, only a showing that Egly did not recognize the function of the inherently present interstitial air. As noted previously, an insufficient scientific understanding does not defeat a showing of inherency. In fact, even in Egly itself, the only way taught for removing interstitial air is the addition of more emulsion. See id., col. 1, ll. 50-55. Egly, however, teaches the use of a broad range - between 20% and 67% by weight - of water-in-oil emulsion. See id., col. 3, ll. 21-24. While Egly compositions containing amounts approaching 67% by weight of water-in-oil emulsions may have little or no entrapped air, the evidence established that at emulsion levels below 40%, Egly compositions "inevitably and inherently" trap sufficient amounts of air to

enhance sensitivity. This evidence included both substantial amounts of expert testimony and data showing extensive testing of Egly compositions.

Finally, although the record showed that special mixing techniques - such as grinding and screening the AN particles - remove interstitial air from the blasting compositions, Egly did not teach or suggest any such techniques. Thus, although Egly may have suggested removal of air, it nonetheless inherently contained interstitial aeration sufficient to enhance sensitivity when comprised of elements within the Clay patent ranges. Consequently, this court discerns no clear error in the district court's conclusion that Egly compositions within the range of the Clay patent claims inherently contain sufficient air to enhance sensitivity.

Based upon all the evidence, substantial amounts of which were not before the PTO in its reissue examination, the district court concluded that IRECO had proven

clearly and convincingly that, unless extraordinary measures are taken to grind and screen ammonium nitrate, the existence of "interstitial air," or sufficient

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aeration to sustain a stable detonation, is a function of the ratios of emulsion to solid constituent. Specifically, at ratios of 30% emulsion and 70% solid constituent, which are common to the Clay Patent, the Egly Patent, and the Butterworth Patent, there is inherently sufficient aeration to sustain a stable detonation, barring extraordinary efforts to grind and screen the ammonium nitrate used in the solid constituent.

This court discerns no clear error in the district court's factual determination that the prior art inherently possesses sufficient aeration to enhance sensitivity to a substantial degree within the overlapping ranges. Nor does this court discern clear error in the district court's finding of anticipation based on either Egly or Butterworth. To uphold the Clay patent and its reissue would preclude the public from practicing the prior art.

III.

In conclusion, this court affirms the district court's finding of invalidity with respect to claims 1, 2, 3, 10, 12, 13, and 14 of the Clay patent and the Clay reissue patent. This court therefore does not address the district court's additional finding of non-infringement.

COSTS

Each party shall bear its own costs.

AFFIRMED.

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976 F.2d 1559
61 USLW 2236, 24 U.S.P.Q.2d 1321
MINNESOTA MINING AND MANUFACTURING COMPANY, Plaintiff-Appellee,
v.
JOHNSON & JOHNSON ORTHOPAEDICS, INC., Defendant-Appellant.
No. 91-1428.
United States Court of Appeals,
Federal Circuit.
Sept. 30, 1992.
Rehearing Denied; Suggestion for
Rehearing In Banc Declined
Nov. 30, 1992.

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Before RICH, Circuit Judge, SMITH, Senior Circuit Judge, and RADER, Circuit Judge.

RICH, Circuit Judge.

Johnson & Johnson Orthopaedics, Inc. (JJO) appeals from the judgment of the United States District Court for the District of Minnesota, Fourth Division, Civil Action No. 4-86-359, holding JJO liable for infringement of claims 1-4 and 8 of U.S. Patent No. 4,502,479, issued to Garwood et al. in 1985 (the Garwood patent); willful infringement of claim 1 of U.S. Patent No. 4,609,578, issued to Reed in 1986 (the Reed patent); willful infringement of claims 12

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and 17 of U.S. Patent No. 4,667,661, issued to Scholz et al. in 1987 (the Scholz patent); and willful infringement of claims 3, 4, 10, 11, 12, 18, 21 and 43 of U.S. Patent No. 4,774,937, issued to Scholz et al. in 1988 (the Scholz II patent). The patents relate to orthopedic casting tapes and, more specifically, to resin based casting systems which have replaced plaster casts. The district court awarded Minnesota Mining And Manufacturing Co. (3M) damages of $53,636,348 and prejudgment interest in the amount of $9,525,000 and also awarded double damages based on JJO's willful infringement. We affirm.

I.

BACKGROUND

A. The District Court Opinion

This case originally involved four U.S. patents and was tried before a Special Master, Janice M. Symchych (the Master). The lawsuit was filed by 3M against JJO alleging willful infringement of the four above-mentioned patents, misappropriation of trade secrets, theft,

and receipt of stolen property. JJO counterclaimed for violation of antitrust laws and a declaratory judgment of patent invalidity and unenforceability on the four patents, as well as damages for fraudulent procurement and claims under Minnesota law for fraud, unfair competition and deceptive trade practices.

The trial lasted thirty-four days, involved the testimony of 32 witnesses and over one thousand evidentiary exhibits, and resulted in 435 findings of fact and 86 conclusions of law made by the Master. The Master's findings of fact/conclusions of law, and memorandum opinion are set forth at Minnesota Mining And Mfg. Co. v. Johnson & Johnson Orthopaedics, Inc., Civil Action No. 4-86-359, 1991 WL 441901, 1991 U.S. Dist. LEXIS 11451 (D.Minn.-Fourth Div. April 30, 1991) and 1991 U.S. Dist. LEXIS 14823 (D.Minn.-Fourth Div. April 30, 1991), respectively. The Master's decision was reviewed by the district court in connection with the parties' motions related to the Master's report. These motions included JJO's opposition to the Master's report.

The district court subsequently issued an opinion dated July 26, 1991, 1991 WL 340579, based on the Master's findings of fact, conclusions of law, and memorandum opinion holding that the Garwood, Reed, Scholz and Scholz II patents are valid and enforceable, and that JJO infringed claims of all four patents. All of JJO's counterclaims were dismissed with prejudice. Damages and interest as above stated were awarded. Finally, the district court enjoined JJO from continued infringement of the patents in suit.

Since the district court adopted the Master's findings, we refer to the district court's findings in this opinion as the Master's findings.

On appeal, JJO challenges the Master's findings that: (1) the Scholz and Garwood patents are valid and infringed; (2) there was no inequitable conduct committed by 3M during the prosecution of the Scholz and Reed patent applications before the U.S. Patent and Trademark Office (PTO); (4) JJO willfully infringed the Scholz and Reed patents; and (5) 3M was entitled to the award of damages amounting to $53,636,348 (before doubling).

B. General Technology

The inventions involved in this case relate to synthetic orthopedic casting tapes which have replaced plaster of paris bandages which had been the preferred means used to immobilize broken or fractured bones for over a century. Plaster casting tapes are activated by dipping and squeezing them in water which causes them to become creamy and smooth. In this state, the bandages can easily be rubbed and smoothed in order to shape the cast around the area of a broken or fractured bone. The bandages are then allowed to harden to form a solid cast.

Plaster of Paris casts were originally preferred because they are easy to apply and mold around broken limbs. However, plaster casts suffer from several drawbacks because they are slow to harden, heavy, relatively nonporous, do not allow

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the skin to "breathe," and readily break down when exposed to water.

During the 1970s several attempts were made in the casting field to develop a synthetic casting product that would retain the advantages of plaster (i.e., its slipperiness and smoothability) while overcoming its drawbacks by being lightweight, porous, quick to harden, and water resistant. Two main components were involved in these developments. The first was a substrate or backing which comes in the form of a knitted or woven fabric (i.e., a scrim) cut into narrow strips or tapes; the second was a resin which is coated on or impregnated in the substrate and hardens after it is activated.

Three major players in the synthetic casting industry--3M, JJO, and Cutter Biomedical (Cutter), a U.S. subsidiary of Bayer A.G. (Bayer), a German Chemical Company--evolved

in the market, each hoping to develop a synthetic cast that would replace plaster of paris as the industry standard. Ultimately, 3M and JJO became the industry leaders, obtaining a combined market share of about 70-90% from 1985 to 1991. However, based on the Garwood, Reed, Scholz, and Scholz II inventions, 3M emerged as the undisputed industry leader, controlling approximately half the market from 1985 to 1991. With each new invention, 3M introduced a new casting product. JJO would then copy the product and introduce a corresponding competitive casting product. The level of competition rose to the point where, in November, 1985, JJO obtained trade secrets stolen from 3M by Philip Stegora, a 3M chemist. These were samples of 3M's slippery resin product disclosed in the Scholz and Scholz II patents, which had not yet issued. JJO analyzed the samples and later filed a patent application based on technology culled therefrom.

C. The Garwood Patent

The Garwood patent discloses an improved orthopedic casting material, invented by Dr. Donald C. Garwood and Dr. Shiraz A. Kathiriya, which is strong, lightweight, porous, and quick curing. The material is obtained by combining knit fiberglass fabric from 0.020-0.045 of an inch thick and having 20-200 mesh openings per square inch with a water-curable polyurethane prepolymer resin described in U.S. Patent No. 4,376,438, issued March 15, 1983 to Straube et al. (the Straube patent).

D. The Reed Patent

The Reed patent discloses a method for obtaining an improved resin coated casting tape, invented by Dr. Katherine Reed, which is comprised of a knitted fiberglass fabric that is heat-set essentially without tension (i.e., in a relaxed state) in order to retain a substantial portion of its extensibility or stretchability (i.e., at least 20 percent in the lengthwise direction prior to curing) while eliminating or preventing frayed ends on the fabric which become sharp and needle-like when the resin hardens. The patent claims both a method and apparatus.

Dr. Reed discovered that if fiberglass is heat set in a relaxed state, a fabric is obtained which retains a substantial amount of its extensibility and will be free of frayed ends when cut. Prior to this discovery, persons in the casting art were forced to choose between a fabric having one or the other, but not both features.

E. The Scholz Patent

The Scholz patent discloses a curable resin coated sheet (i.e., such as casting tape) which includes an additive lubricant at a major surface of the sheet, present in an amount sufficient to reduce the kinetic coefficient of friction (KCOF) of the casting tape to less than about 1.2. The patent sets forth a test for determining the KCOF of a casting tape.

Dr. Reed and Dr. Matthew Scholz discovered that including lubricants in the resin reduces the tackiness or stickiness of the casting tape surface by making the resin slippery. In this state, the cast can be rubbed and smoothed during the application process. In addition, although the resin was slippery the casting tape layers retained their ability to bond together (i.e., the layers do not delaminate).

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II.

DISCUSSION

A. The Scholz Patent

1. Anticipation

JJO alleges that claims 12 and 17 of the Scholz patent are anticipated by a number of prior art commercial casting tape products and U.S. and Japanese patents. Claims 12 and 17, read:

12. An article comprising a curable resin-coated sheet having a lubricant at a major surface of the coated sheet, wherein said

lubricant comprises an additive which is a mixture of any of the compositions selected from the group consisting of a surfactant, a polymer comprised of a plurality of hydrophilic groups, and a polysiloxane, and wherein said lubricant is present in an amount such that the kinetic coefficient of friction of the coated surface of the sheet material is less than about 1.2.

17. An article comprising a pre-lubricated curable resin-coated sheet wherein the curable resin is a water-curable isocyanate-functional prepolymer which is a derivative of an aromatic polyisocyanate and wherein a major surface of the sheet exhibits a kinetic coefficient of friction of less than about 1.2.

According to JJO, each of the prior art casting products and references either teach or contain chemical compositions such as silicone and polyethylene which are lubricants identified in the Scholz patent and, therefore, meet the respective claim limitations in claims 12 and 17. JJO's argument centers on the claim language "a lubricant at a major surface of the coated sheet" in claim 12 and "a pre-lubricated curable resin-coated sheet" in claim 17. According to JJO, the claims were interpreted so as to include an additional and extraneous "slipperiness" limitation. In other words, the claims only require the presence of a lubricant, but were erroneously interpreted by the Master to require some degree of slipperiness. As a result of this interpretation, JJO argues, the prior art items disclosing the presence of a lubricant in a casting system were rejected by the Master because they were not slippery.

A party asserting that a patent claim is anticipated under 35 U.S.C. § 102 "must demonstrate, among other things, identity of invention." Kalman v. Kimberly-Clark Corp., 713 F.2d 760, 771, 218 USPQ 781, 789 (Fed.Cir.1983), cert. denied, 465 U.S. 1026, 104 S.Ct. 1284, 79 L.Ed.2d 687 (1984), overruled in part on another ground, SRI Int'l v. Matsushita Elec. Corp. of Am., 775 F.2d 1107, 1125, 227 USPQ 577, 588-89 (Fed.Cir.1985) (in banc). Identity of invention is a question of fact, and one who seeks such a finding must show that each element of the claim in issue is found, either expressly or under principles of inherency, in a single prior art reference, or that the claimed invention was previously known or embodied in a single prior art device or practice. Id. As a question of fact, the district court's finding is subject to review under the clearly erroneous standard. Tyler Refrigeration v. Kysor Indus. Corp., 777 F.2d 687, 690, 227 USPQ 845, 847 (Fed.Cir.1985).

To review the district court's finding, we first have to construe the claims. Kalman, 713 F.2d at 771, 218 USPQ at 789. Claim construction is a question of law. However, when the meaning of key terms of the claim is disputed, as in this case, and extrinsic evidence is necessary to explain the terms, then underlying factual questions may arise. Johnston v. IVAC Corp., 885 F.2d 1574, 1579, 12 USPQ2d 1382, 1385 (Fed.Cir.1989). When the interpretation of claims requires findings of underlying fact, those factual findings are reviewed in accordance with the appropriate evidentiary standard, i.e., that of clear error. Perini America, Inc. v. Paper Converting Machine Co., 832 F.2d 581, 584, 4 USPQ2d 1621, 1624 (Fed.Cir.1987).

a. Claim Interpretation--The Meaning of the Terms

"Lubricant" and "Pre-lubricated"

The Master rejected JJO's argument because the chemicals, although present in the prior art, were used for other non-lubricating functions and did not "lubricate"

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as this term is understood from the Scholz specification. The Master found that the prior art cited by JJO either exhibits or teaches a casting system that uses or describes the tacky resin technology. As a result, they either teach or exhibit a tacky resin that cannot be smoothed during the molding process as required by the

claimed invention. Although there is no express limitation in the claims of "smoothed during the molding process," that property is an aspect of "having a lubricant at a major surface" or being "pre-lubricated."

The Master concluded that the claims should be interpreted in accordance with their relation to a casting tape which is pre-lubricated and exhibits a low KCOF because the lubricant has caused the resin on the tape to become slippery when activated. Although the word "slippery" is not found in the claims, the Master found it necessary to use the specification in order to determine what the inventor meant by terms and phrases in the claims. This is entirely proper. E.I. du Pont de Nemours & Co. v. Phillips Petroleum Co., 849 F.2d 1430, 1433, 7 USPQ2d 1129, 1131 (Fed.Cir.), cert. denied, 488 U.S. 986, 109 S.Ct. 542, 102 L.Ed.2d 572 (1988). In defining the meaning of key terms in a claim, reference may be had to the specification, the prosecution history, prior art, and other claims. Tandon Corp. v. International Trade Comm'n, 831 F.2d 1017, 1021, 4 USPQ2d 1283, 1286 (Fed.Cir.1987). This is not, however, to be confused with reading into a claim a limitation appearing in the specification but not in the claim. E.I. du Pont de Nemours, 849 F.2d at 1433, 7 USPQ2d at 1131.

The fundamental purpose and significance of the Scholz invention is to produce a non-sticky or non-tacky resin (i.e., a slippery resin) to permit smoothing and forming of the casting tapes, thereby overcoming the "tacky resin" problem of the prior art. 1 This is evident throughout the patent specification. In the background section of the specification, Scholz describes the problems that existed with prior art resins used on orthopedic casting tapes:

[T]hese resins are quite tacky until cured. This tackiness makes it difficult to mold the cast to the patient's limb as the resin tends to stick to the protective gloves worn by the cast applier. For example, after the rolls are wrapped but before they harden, some working time is necessary in order to mold the casts to fit the limb. This is accomplished by smoothing the cast with a gloved hand as well as holding the cast at certain points until it hardens. When a roll of tape coated with a tacky resin is used, molding the cast is difficult. The reason for this difficulty is that the glove sticks to the resin and when attempts are made to smooth the cast and form it, the layers of tape pull apart from each other thus requiring reforming of part of the cast.

To overcome these problems, Scholz identifies different lubricants and how they are used to reduce the tackiness or stickiness of the surface of the casting tape by making the resin slippery. This in turn allows the bandages to be smoothed in various directions as is done with plaster of paris casts. The specification is replete with examples of how the lubricants are selected and what they accomplish. With respect to one type of lubricant, the specification states:

One aspect of this invention is a sheet, e.g., a scrim, coated with a curable resin wherein one or more hydrophilic groups are chemically bound to the resin. When this orthopedic casting material is brought into contact with water, the hydrophilic group causes the resin to become slippery.

The specification also evaluates and distinguishes between different additive lubricants to determine which ones are better able to reduce the tackiness of the resin:

Unlike the materials discussed above, the silicone based fluids dramatically reduced the tackiness of the resin and surprisingly did not affect the other properties

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of the cast and even at elevated temperatures remained on the surface of the resin and remained slippery.

The specification further describes and refers to various lubricants that "yield the desired non-tacky or slippery casting materials," "[cause] the resin to become slippery," "give a non-tacky and even slippery feeling surface,"

"[remain] on the surface of the resin and [remain] slippery," and "enhance the slippery feel of the casting tape."

Finally, overcoming the problems experienced in the prior art, the Scholz patent describes how the lubricated casting tape is used:

When immersed in water, the tapes quickly become very slippery. The rolls unwind easily and do not stick to gloves. After the roll is wrapped around the limb, molding of the cast becomes easy due to the non-tacky nature of the resin. The cast can be rubbed over its entire length without sticking to the gloves and the layers of tape do not separate from each other. This pre-lubricating resin approaches the handling characteristics of plaster of Paris bandages very closely.

Based on our review of the specification, it is quite clear the Master did not read an extraneous limitation into the claims. What the patentee meant by the term "lubricant" and the phrase "pre-lubricated resin coated sheet" is evident from the specification. To speak of "a lubricant at a major surface of the coated sheet" or "a pre-lubricated curable resin-coated sheet," especially in light of the specification's emphasis on obtaining a slippery feel or slippery surface, means exactly what one would expect when a lubricant is placed on a surface--that the surface is slippery. Accordingly, we find that the Master's interpretation of the claims is correct.

JJO's next argument is that this interpretation renders the claims indefinite because it is impossible to know how "slippery" the product has to be. However, JJO's argument is improperly framed in its use of the term "slippery" because this term is not used in the claims. The claims only require lubrication. The term "slippery" was used by the Master to define and explain what was meant by the term "lubricant."

The amount of lubrication required is laid out in the specification and should be sufficient to achieve the fundamental purpose of the invention--the ability to smooth and rub the casting materials during molding without the resin and tape sticking to the applicator's hands. In addressing a similar issue, this Court in Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc., 796 F.2d 443, 450, 230 USPQ 416, 421 (Fed.Cir.1986), cert. denied, 484 U.S. 823, 108 S.Ct. 85, 98 L.Ed.2d 47 (1987), ascertained the meaning of the term "smooth" based on a review of extrinsic evidence:

Disputed issues such as the meaning of the term "smooth," should be construed by resort to extrinsic evidence such as the specification, other claims, and the prosecution history. Here, resort to the specification clearly demonstrates that "smooth" meant that "the edges of the craters neither inflame nor irritate the eyelid of the lens wearer * * *." ... Testimony from Dr. Mandell, Bausch & Lomb's expert in the field of contact lenses, indicates that to a person of ordinary skill in the art, smooth would mean an absence of "roughness or significant elevation" so that a wearer "would not feel it with the [eye]lid." ...

We hold that smooth means smooth enough to serve the inventor's purposes, i.e., not to inflame or irritate the eyelid of the wearer or be perceived by him at all when in place. [Emphasis ours.]

Likewise, we do not perceive any difficulty or confusion in determining what is "lubricated" and what is not lubricated in terms of the Scholz patent. That is, lubricated products are products that can be rubbed and smoothed to allow molding of the cast without the resin and tape sticking to the applicator's hands or gloves.

b. Claim Interpretation--Whether the Master Required the

KCOF to be Calculated on a "Standard Substrate"

JJO's next argument is that the Master's findings indicate that her interpretation

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of the claims erroneously requires a "standard substrate" limitation. This argument relates to the claim limitation requiring "a KCOF of less than about 1.2." According to JJO, the Master required the KCOF to be calculated using the same type of substrate or scrim that is used in the Scholz patent in order to determine whether the prior art anticipated (i.e., had a KCOF of less than about 1.2) and then failed to require the use of the same type of substrate to determine infringement.

JJO relied on a number of individual "findings of fact" (FF) made by the Master which, when read out of context with the Master's entire findings, appear to support JJO's argument. However, when the findings are reviewed in context, their meaning is clear. We address two of them here.

In FF-73 the Master states:

73. The Scholz 1 patent sets forth a test for determining the KCOF of a casting tape. The test method is based on the American Society for Testing Materials Standards, ASTM D 1894, "Standard Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting", which is referenced in the patents. The test is conducted by pulling a special "sled" a specified distance of travel along the length of an 18 to 24 inch sample of tape. The KCOF test can be used to compare the relative slipperiness of resins. A person of ordinary skill in the art understands that to accurately compare resins, the serims [sic] of the casting tapes upon which the resins are applied must be the same. [Emphasis ours.]

The Master does not say that to find infringement or anticipation the KCOF must be determined on a particular scrim. The Master merely found that the KCOF can be used to compare the relative slipperiness of the resins. 2 This finding is used by the Master to address whether 3M was guilty of inequitable conduct.

JJO cites FF-315, also out of context, in support of its argument:

315. Scotchflex XF and Red Label registered low KCOF values because their fabric substrates were different from the substrate used in all tests and examples submitted with the Scholz applications. Scholz teaches a pre-lubricated resin system, and is unrelated to fabric substrate. Accordingly, to obtain an accurate comparison of resin slipperiness, it is essential to keep the substrate constant. [Emphasis ours.]

This finding also relates to the inequitable conduct issue and why it was not necessary for 3M to report certain prior art to the PTO during 3M's prosecution of the Scholz patent. 3 The Master was not interpreting the claims to require a constant substrate, but merely explaining why 3M's failure to report the test data to the PTO did not constitute inequitable conduct--the two products were part of the sticky prior art and were not pre-lubricated. 4 The relative insignificance of the unreported prior art was shown when the resins were tested on the same substrate used in the Scholz patent and produced KCOFs well above 1.2. JJO should have understood this because it

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is explained in FF-314, FF-316 and FF-317, none being mentioned in JJO's analysis. Thus, the Master did not require that the KCOF be calculated on a standard substrate.

c. Analysis of the Prior Art

Having determined the proper construction of the claims, the Master went on to determine that the patents and commercial products identified by JJO did not anticipate the Scholz patent. Because these findings are addressed in detail in the Master's report, we touch on them only peripherally here. The chemicals that JJO alleges are lubricants do not anticipate because they are either used in the wrong form or in too small an amount to function as lubricants as required by the claims. For example, silicone, identified in the Scholz patent as a lubricant, is described in the prior art and used in a number

of commercial products. However, the Master found, among other things, that silicone is used and described in the prior art as an anti-foaming agent and in an amount insufficient to serve as a lubricant that prevents the resin from becoming tacky during molding. 5

The Master also found that this was JJO's understanding of the prior art. JJO represented in the patent application it filed based on the misappropriated trade secrets that prior art polyurethane resin often included 0.1-1% silicone as an antifoaming agent and does not suggest that in such small amounts silicone reduces the tackiness of the resin.

With one exception, each of the products identified by JJO was demonstrated at trial and each displayed a tacky resin. The Master found that, even though some of the prior art products had KCOF values below 1.2, none was shown to include pre-lubricated resins or to have a lubricant at a major surface.

Likewise, the Master rejected other resins alleged to be anticipatory that included chemicals that, although identified as lubricants in the Scholz patent, were used in different forms that did not function or act as lubricants. For example, the prior art describes a polyurethane resin that uses a polyethylene oxide in liquid form the purpose of which is to draw water into the resin to promote a fast cure. However, as set forth in the Scholz patent, liquid forms of polyethylene oxide do not work as lubricants in polyurethane resins.

The Master found these findings were also in line with the representations made by JJO to the PTO during the prosecution of its slippery resin patent application. Finally, variations of the prior art resins containing polyethylene were demonstrated at trial and all were shown to be sticky. Thus, the Master found the resins did not include a lubricant and were not pre-lubricated. Accordingly, we find no clear error in the Master's decision that the Scholz patent is not anticipated.

2. Inequitable Conduct

JJO alleges that 3M intentionally withheld material prior art, which 3M knew had KCOF values at or near 1.2, from the PTO and that this alleged misconduct independently "invalidates" the Scholz patent. First, we note that proving inequitable conduct does not "invalidate" a patent. Rather, it renders the patent unenforceable. Kingsdown Medical Consultants Ltd. v. Hollister Inc., 863 F.2d 867, 877, 9 USPQ2d 1384, 1392 (Fed.Cir.1988). Although the practical effect may be the same, the legal concepts are quite different.

Second, a finding of inequitable conduct is committed to the discretion of the trial court and is reviewed by this court under an abuse of discretion standard. Kingsdown, 863 F.2d at 876, 9 USPQ2d at 1392. To overturn a discretionary ruling of a district court, the appellant must establish that the ruling is based upon clearly erroneous findings of fact or a misapplication or misinterpretation of applicable law or that the ruling evidences a clear error of

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judgment on the part of the district court. Id.

The Master found that JJO failed to prove that the prior art was material or that 3M intended to deceive the PTO. JJO has failed to convince us that the Master's findings are clearly erroneous or that the Master misapplied or misinterpreted any law.

3. Infringement of the Scholz Patent

A determination of patent infringement under 35 U.S.C. § 271(a) requires a two step analysis--first, the language of the claim at issue must be interpreted to define its proper scope and, second, the evidence before the court must be examined to ascertain whether the claim has been infringed, whether the claim "reads on" the accused product or process. The first inquiry is a question of law for the court while the second is a question of fact. C.R. Bard, Inc. v. Advanced Cardiovascular Sys., 911 F.2d 670, 673, 15 USPQ2d 1540, 1543 (Fed.Cir.1990); Standard

Oil Co. v. American Cyanamid, 774 F.2d 448, 452, 227 USPQ 293, 295-96 (Fed.Cir.1985).

For infringement purposes the Master classified JJO's slippery resin products into two categories, the S-Thane products and the U-Thane products, based on the name of the two resins the products used. The S-Thane resin was introduced in September 1986 and used until September 1990 when JJO started using a new slippery resin called U-Thane. The Master found that both the S-Thane and U-Thane casting tape products literally infringed claims 12 and 17 of the Scholz patent and that the U-Thane products also infringed under the doctrine of equivalents.

On appeal of the infringement issue JJO again argues that the Master construed the claims for validity purposes, to require the KCOF measurements to be taken on a standard substrate and failed to do the same in her infringement determination. Relying on this premise, JJO argues that there is no evidence of infringement because the KCOF values obtained on its S-Thane and U-Thane products were not determined on the standard substrate. As we have already determined in our review of JJO's anticipation defense that the tribunals below made no such error, we find it unnecessary to address this issue again except with respect to testimony offered by JJO in further support of its argument. With respect to this testimony we note only that it, like the findings of fact used to support JJO's anticipation defense, was taken out of context of what a fair reading indicates was actually said.

Furthermore, we note that there is no question the S-Thane products infringe because this was conceded by JJO prior to trial. In its pre-trial Case Analysis report submitted to the court, JJO admitted that, if the Scholz patent is valid, then JJO's S-Thane products infringe. Therefore, we turn our attention to JJO's argument that there is insufficient evidence to support the Master's finding that JJO's U-Thane products infringe claims 12 and 17 of the Scholz patent.

The issue here turns on the second part of the infringement analysis--whether the Master clearly erred in finding that JJO's U-Thane products have at least one major surface exhibiting a KCOF of less than about 1.2. There is no dispute that the U-Thane products meet all other limitations of claims 12 and 17.

To prove their respective positions, both JJO and 3M conducted KCOF tests using the U-Thane resin except that 3M conducted its tests on actual batches of commercial U-Thane products while JJO conducted its tests on U-Thane resin applied to factory experiment casting tape. The Master's findings indicate that after running two sets of tests, 3M obtained an average KCOF of 0.86 for the back side of the tape (facing the inside of the roll) and an average KCOF value of 1.12 for the face side of the tape (facing the outside of the roll). JJO obtained a combined average KCOF for both sides of the tape of 1.59. The Master credited 3M's data as more reliable than JJO's because 3M conducted its tests in accordance with the directions in the Scholz patent and on commercial batches of JJO casting tape while JJO's

data was generated from tests conducted on experimental tape.

On appeal, JJO presents two reasons why it believes the KCOF values obtained by 3M are unreliable and, therefore, erroneously relied on by the Master. First, JJO argues that 3M failed to take an equal number of readings in each direction and therefore the averages are unreliable. Second, JJO argues that the samples used to conduct 3M's tests were defective because they exhibited pooling or puddling of the resin 6 and therefore rendered the test results unreliable. Our review of the test results in connection with the Master's findings lead us to conclude that the Master's decision is not clearly erroneous.

The Master's findings indicate that the KCOF can be determined by taking either an

average or mean value of sled readings. Although readings must be taken in both directions, there is no requirement that the number of readings in each direction must be equal. JJO has failed to identify any evidence to suggest otherwise. Under the ASTM method referenced in the patent, the test is conducted a sufficient number of times to determine the mean or average KCOF value of a surface, and it is the mean value which is reported. The patent states with sufficient clarity that it is the average or mean KCOF value of a major surface that is to be determined and any directional effects will be accommodated by the processes of averaging.

Although we recognize that an even number of readings taken in both directions might result in a more accurate result, we also note that one reading short in one direction does not necessarily render the KCOF value obtained unreliable or inaccurate. This is quite apparent from a comparison of the KCOF values obtained for the back side of the tapes in 3M's June 1990 and September 1990 tests wherein the September 1990 test was based on an equal number of values taken in both directions. The KCOF values obtained under both methods are virtually the same (i.e., .85 and .87, respectively). Thus, under either method, at least one side of the product had a KCOF averaging below 1.2, thereby meeting the claim limitation of claim 17 ("wherein a major surface of the sheet exhibits a kinetic coefficient of friction of less than about 1.2").

JJO's second argument also does not establish that the Master clearly erred in making its infringement decision. In 3M's June 1990 test 3M obtained an average KCOF of 0.69 for the face side of the tape. In 3M's September 1990 test, run on samples produced by JJO pursuant to a court order, 3M obtained an average KCOF of 1.27 for the face side. Dr. Reed attributed the difference in the results to the condition of the samples produced by JJO testifying that the samples were not produced in their original containers and exhibited a significant amount of resin puddling on the rolls. 7 When all the values were combined and averaged the KCOF value for this side of the tape was 1.12. Relying on this KCOF value, the Master again determined that JJO's products infringed. In contrast to the test results presented by 3M, JJO offered test results showing that the KCOF of its U-Thane products is over 1.2. JJO tested its product a total of eleven times, and in every case, the average KCOF for each side exceeded 1.2.

In view of the different results and conflicting evidence produced by 3M and JJO, the Master was forced to make a credibility determination as to which results were more reliable. This determination was expressly made in favor of 3M because she deemed the results obtained from 3M's tests, made on rolls taken from commercial batches of product sold by JJO, more reliable than the results obtained from JJO's data generated from tests conducted on factory experiments. The Master's findings also indicate that she believed that 3M's tests were conducted in accordance

with the procedures outlined in the Scholz patent.

We find no clear error in the Master's decision and, accordingly, affirm her finding of literal infringement. Having affirmed the Master's finding of literal infringement we find it unnecessary to consider the Master's finding of infringement under the doctrine of equivalents.

B. The Garwood Patent

1. Anticipation

JJO argues that the Master erred as a matter of law by failing to hold claim 1 of the Garwood patent anticipated by the Straube patent. JJO argues that during the prosecution of the Garwood patent 3M reviewed the Straube patent and, based on the information provided, was able to calculate a range of mesh sizes and thickness parameters that encompassed the range of measurements claimed in the Garwood patent.

As a result, JJO argues that 3M is now estopped from arguing that Straube does not disclose the measurements claimed in Garwood.

Claim 1 provides:

1. An orthopedic casting material comprising a fabric made from a fiber having an initial modulus of elasticity greater than 8 X 10 6 pounds per square inch, said fabric having a thickness between 0.020 and 0.045 inch and a mesh size of 20 to 200 openings per square inch and a reactive fluid polyisocyanate prepolymer resin impregnated in said fabric which hardens when said resin is wetted with water.

Absence from the Straube patent of any claimed element negates anticipation. Atlas Powder Co. v. E.I. Du Pont De Nemours & Co., 750 F.2d 1569, 1573-74, 224 USPQ 409, 411 (Fed.Cir.1984).

The Master found no anticipation because the Straube patent does not include any mesh size or thickness parameter for the knit fiberglass fabric substrate mentioned in the Garwood claim. The Master found that the ranges 3M extrapolated from Straube are "so broad as to be meaningless to one skilled in the art. The Straube patent provides no guidance as to how to construct a fiberglass cast with the beneficial properties achieved by the Garwood invention; strength, porosity, lightness, and ability to cure quickly." The Master recognized that although Garwood's specific claims are subsumed in Straube's generalized disclosure of knit fiberglass as a substrate, this is not literal identity. The Master also relied on the fact that the PTO specifically considered the effect of the Straube patent on the Garwood application. Where the PTO has considered a piece of prior art, and issued a patent notwithstanding that prior art, a court owes some deference to the PTO's decision. American Hoist & Derrick Co. v. Sowa & Sons, Inc., 725 F.2d 1350, 1360, 220 USPQ 763, 771 (Fed.Cir.), cert. denied, 469 U.S. 821, 105 S.Ct. 95, 83 L.Ed.2d 41 (1984).

We find no error in the Master's determination that Straube does not anticipate. In order to anticipate, the Straube patent must sufficiently describe the claimed invention to have placed the public in possession of it. The record establishes that the Straube patent does not do this. It merely states in a very general way that fiberglass can be used as a substrate. However, neither the information provided in the Straube patent nor 3M's interpretation thereof are exact enough to identify the ranges claimed in Garwood.

2. Obviousness

JJO argues on appeal that it would have been obvious to one of ordinary skill in the art to combine a polyurethane resin and fiberglass substrate with Garwood's thickness and mesh parameters. JJO alleges that the use of the polyurethane resin on fiberglass substrates was disclosed in the Straube patent and in a 1977 article entitled Development Of A Water-Activated Plastic Cast, authored by M.J. Lysaght and T.R. Rich (the Lysaght/Rich article).

Whether the claimed invention would have been obvious at the time the invention was made is reviewed de novo by this court although the underlying factual inquiries (e.g., the scope and content of the

prior art, level of ordinary skill in the art, and differences between the prior art and the claimed invention) are reviewed under the clearly erroneous standard. Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1379-80, 231 USPQ 81, 90 (Fed.Cir.1986), cert. denied, 480 U.S. 947, 107 S.Ct. 1606, 94 L.Ed.2d 792 (1987). In addition, objective evidence such as commercial success, failure of others, long-felt need, and unexpected results must be considered before a conclusion on obviousness is reached. Id. Indeed, as then Chief Judge Markey said in Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 1538, 218 USPQ 871, 879 (Fed.Cir.1983), "evidence of secondary considerations may often be the most probative and cogent evidence in the record. It may often establish that an invention appearing

to have been obvious in light of the prior art is not."

In spite of the importance that the secondary considerations of commercial success, long felt need, and failure of others played in the considerations of both the PTO and the Master, JJO conspicuously fails to address them. Again, borrowing from Chief Judge Markey's language, we note that JJO "adopts the frequent and foolish appellate ploy of citing only such bits of evidence as may support its view, while ignoring the wealth of evidence that establishes the district court's well reasoned findings to have been not clearly erroneous." Datascope Corp. v. SMEC, Inc., 879 F.2d 820, 825, 11 USPQ2d 1321, 1324 (Fed.Cir.1989), cert. denied, 493 U.S. 1024, 110 S.Ct. 729, 107 L.Ed.2d 747 (1990).

a. Scope and Content of the Prior Art

JJO argues that the resin and fiberglass substrate used in the Garwood patent are both disclosed in the prior art and that their combination was suggested by the Lysaght/Rich article. The resin disclosed in Garwood is the same resin disclosed in the Straube patent and used in other commercial products while the fiberglass substrate is the same substrate used in 3M's Lightcast products in 1976. 8 JJO argues that all 3M did was follow the express teachings of the Lysaght/Rich article and combine the two materials.

The Lysaght/Rich article, like the previously discussed Straube patent, recognizes that fiberglass can be used as a scrim or substrate material. However, like the Straube patent, the Lysaght/Rich article does so in a very general fashion providing no detail as to how to combine the fiberglass substrate and resin to achieve the results obtained by Garwood. Specifically, the article states:

Cotton gauze yielded a cast with the tactile feel of a plaster of paris cast while coarse fiberglass gave a more rigid, almost bristly, material (akin to Lightcast). The highest strength-to-weight ratio and best overall "feel" were achieved with fine-weave fiberglass.

Other than mentioning fiberglass as a possible substrate, the article provides no guidance or detail as to how to solve the problems overcome by the Garwood invention or how to construct a fiberglass cast with the beneficial properties achieved by the Garwood invention.

Neither the Straube patent, for the reasons discussed in relation to JJO's anticipation defense, nor the Lysaght/Rich article disclose the thickness and mesh parameters in claim 1 of the Garwood patent.

b. The Level of Ordinary Skill in the Art

Neither party has raised any dispute with the Master's determination of what the level of ordinary skill in the casting art was at the time of the Garwood invention. However, we include it here to the extent that it is a necessary part of our analysis in reviewing the obviousness issue.

The Master determined that the level of ordinary skill in the casting art in 1979 would be a person having knowledge of chemistry equivalent to a bachelor's degree, having additional knowledge of resin systems and their curing mechanisms.

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Such a person would also have some experience in designing orthopedic casting materials and, more particularly, in developing backings for use in casting materials. Finally, a person of ordinary skill in the casting art would also have some knowledge of the clinical usage of casting materials.

c. Secondary Considerations

A long felt but unsolved need for a workable resin based casting system is established by the attempts and failures of the major players in the casting field--3M, Bayer, Cutter, and JJO. All were attempting to develop a substitute for plaster based casting systems

using fiberglass as the substrate, and all but 3M failed. This is uncontested by JJO.

Scientists from Bayer and Cutter, including Dr. Gunther Lehnert, a co-inventor on the Straube patent, tested different fabrics, including fiberglass, for potential use with the Straube resin. After running into a number of problems, the two companies ultimately concluded that fiberglass was not a suitable casting material to be used with polyurethane resin. For example, Bayer was unable to find a way to get the fiberglass layers to laminate well together when using the polyurethane resin. When the resin hardened the layers of fiberglass tended to crack and separate. Cutter ran into similar problems and was unable to impregnate the fiberglass with resin.

Bayer and Cutter were also unable to solve the problem of excessive foaming which occurred during curing and caused the cast pores to clog ruining the cast's porosity. Both companies subsequently abandoned their efforts in developing a fiberglass based system and put their time and resources into developing a cotton/polyester synthetic cast. In 1978, Cutter began marketing its cotton/polyester synthetic cast under the trade name CutterCast.

JJO's attempts also proved unsuccessful. JJO developed a casting system which uses a fiberglass backing in combination with an acrylamide monomer resin, a dry powder that is very dispersible in water. JJO obtained U.S. Patent No. 4,134,397 issued to Gianakakos et al., and developed a commercial product called Chemicast based on the patent. In September 1989, JJO test marketed the product. However, the product took 24-48 hours to achieve weight bearing strength and became so hot during the curing reaction that it could burn the patients. The product was a failure and rejected by the medical community. As a result, JJO withdrew it from the market and, like Bayer and Cutter, decided to pursue a cotton/polyester synthetic product.

Even after 3M introduced Scotchcast, the commercial embodiment of the Garwood patent, into the synthetic cast market JJO remained skeptical of fiberglass. A JJO scientist analyzed Scotchcast upon its release in early 1980 and concluded in a memo dated February 19, 1980, that "Glass is not my substrate of choice!" Five months later, an official at JJO sent a report to the President of JJO, comparing Scotchcast with JJO's cotton/polyester synthetic product referred to internally at JJO as J-THANE. The report stated that:

The major difference between J-THANE and Scotchcast is that we are pursuing a polyester/gauze substrate, while 3M uses a fiberglass substrate. The basic advantages of the J-THANE fabric are better radiolucency, improved conformability, and much better polyurethane/substrate bonding. Fiberglass offers the advantages of using fewer layers to immobilize, greater porosity to reduce skin maceration and itching, and a neater finished cast appearance. Best available data indicate that the overall functionality of fabric overshadows these comparative advantages of fiberglass. It has been reported that 3M is thus investigating an effective fabric substrate.

* * * * * *

A concurrent R & D project was initiated last week to identify an alternative fiberglass substrate for J-THANE. Should the marketplace show an unexpected preference for the fiberglass material, we will be in a position to market a fiberglass product very rapidly.

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The Garwood patent also provided a solution for the foaming problem experienced and left unsolved by Bayer, Cutter, and JJO. Foaming led to poor layer to layer lamination as well as poor porosity. Garwood solved the problem by introducing a silicone anti-foaming agent into the resin system. Prior to the Garwood patent, no orthopedic casting material contained an anti-foaming agent. Bayer, Cutter, and JJO were unable to solve the problem until they became aware of the Garwood patent.

JJO also fails to contest the tremendous commercial success experienced by 3M's Garwood invention embodied in the fiberglass Scotchcast product. Scotchcast revenues increased from $4.7 million in 1980 to over $15 million in 1981. The demand for 3M's product upon its release was so great that 3M was forced to operate on back order for 12-16 months.

The cotton based products sold by Cutter and JJO, CutterCast and Black Label, respectively, were rejected in favor of the Scotchcast product and their sales rapidly declined while Scotchcast sales soared. The cotton/polyester fabrics were too weak and pliable to make good casts. So many layers were required to make a strong cast that the cast became non-porous. In addition, both Cutter and JJO had yet to overcome the foaming and delamination problems with their cotton based casts.

At least by 1983, both Cutter and JJO had acknowledged that 3M's fiberglass Scotchcast product was preferred by the market. In JJO's 1983 marketing plan, JJO noted that 3M had displaced Cutter as the market leader and acknowledged the value placed by the market on casts having the beneficial properties achieved by the Garwood invention:

The initial resistance to the price differential between synthetics and plaster of Paris has been overcome. The value of a lightweight, waterproof, impact-resistant casting material offsets the differential in price.

JJO's marketing plan also noted that Cutter had accepted the fact that fiberglass was preferable to cotton as a casting material. The Master's finding that the commercial success of Scotchcast which is water resistant, lightweight, strong, porous and cures quickly is due to the technical merits of the product is supported by ample testimony in the record and is left uncontested by JJO.

Finally, unable to compete with the overwhelming popularity of 3M's Scotchcast product, JJO and Cutter decided to copy it. JJO copied the Garwood invention when it introduced its Red Label product. Cutter decided to produce a fiberglass product called C-Cast which Burton Dahlen, a former Cutter scientist and manager, admitted at trial was a copy of Scotchcast. Dr. Lehnert at Bayer, abandoned his position that fiberglass would not work with the Straube resin, and Bayer ultimately determined, after reviewing its own Straube patent, that it should take a license under the Garwood patent.

3M stresses the "real world" situation to support the Master's finding of non-obviousness. In the present case, such real world considerations provide a colorful picture of the state of the art, what was known by those in the art, and a solid evidentiary foundation on which to rest a nonobviousness determination. We do not find the Master's findings of fact erroneous. Accordingly, we agree with her conclusion of law that the Garwood patent would not have been obvious to one of ordinary skill in the art at the time of the Garwood invention.

3. Infringement

Here, the issue of infringement centers on whether the Master properly construed claim 1. The Master interpreted the language "a mesh size of ... openings per square inch" to mean the spaces in the knit fabric defined or bounded by the courses (the horizontal elements or threads that run across the fabric) and the wales (the vertical elements or threads that run lengthwise of the fabric).

JJO argues that the Master's infringement finding is based on an erroneous claim construction because an "opening" should be interpreted in functional terms to mean any orifice large enough to allow

water, air and moisture to pass through; and, that the knit fabric it uses is not covered by the claim because it has an array of "curved open loops" intertwined in a horizontal and vertical pattern. These curved loops, JJO argues, should be counted as "openings." 9 When the loops are

counted JJO's fabric has more than 500 openings per square inch through which water and air can pass and, therefore, its products do not infringe. To support its interpretation, JJO relies on the following language in the Garwood patent:

The fabric should be a mesh, i.e., it should have openings through it to enable the curing agent to penetrate into the roll and expose all parts of the resin. Openings in the fabric also facilitate circulation of air through the finished cast and evaporation of moisture from beneath the cast.

It is undisputed that a decision on whether JJO's product infringes claim 1 rests on how the claim is interpreted. If we interpret "openings" to mean any opening through which air and water can pass, then JJO's products do not infringe; if we interpret "openings" to mean openings defined by the courses and wales of the fabric, then JJO's products do infringe.

To ascertain the true meaning of disputed claim language, resort should be made to the claims at issue, the specification, and the prosecution history. C.R. Bard, 911 F.2d at 673, 15 USPQ2d at 1543; Loctite Corp. v. Ultraseal Ltd., 781 F.2d 861, 866-67, 228 USPQ 90, 93 (Fed.Cir.1985). From the claim language itself we see that the inventor claims the number of "mesh size ... openings" per square inch and not merely the number of "openings" per square inch. The term "mesh," by definition, implies a coarseness or fineness of a grid or screen-like structure.

In addition, the Garwood patent compares the various fabrics in terms of "mesh number" and "mesh number openings/in 2." The Master's findings indicate that Table I in the Garwood patent, which lists several commercially available fabrics, sets forth their respective "mesh number openings" that, when examined, correspond with the number of openings calculated by multiplying the number of courses per inch by the number of wales per inch in the fabric. These findings are uncontested by JJO.

Our review of the prosecution history also reveals that Garwood, in addressing a rejection based on the Straube patent, extrapolated the number of mesh number openings in the Straube patent by multiplying the vertical members per inch by the horizontal members per inch. In addition, throughout the Garwood amendment Garwood equates "openings" with "mesh size" and "mesh number" using them interchangeably.

This interpretation of "mesh size ... openings" is also consistent with the prior art which teaches that mesh number openings are calculated based on courses and wales. Other evidence introduced at trial establishes that those skilled in the art understand that mesh size is measured by multiplying the number of wales by the number of courses and that, after reviewing the Garwood patent, they understood the use of the terms therein to be consistent with the ordinary usage of those terms. For example, the lab notebook of Mr. George Buese, a scientist at JJO and a person skilled in the casting art, together with related testimony indicate that prior to this litigation JJO reviewed the Garwood

specification and compared claim 1 to the JJO products in an attempt to get around the claimed invention. The comparison and calculations made show that JJO understood that the mesh size is measured by multiplying the courses times the wales. Likewise, documents obtained from Mr. Burton Dahlen, a former research manager at Cutter and another person skilled in the casting art, together with his testimony establish that Cutter also reviewed the Garwood specification and understood that the number of mesh openings is determined by multiplying the number of courses per inch by the number of wales per inch.

Based on our review of the claims, the specification, the prosecution history, and the testimony of those skilled in the art we find that the evidence presented overwhelmingly supports 3M's interpretation of the claim. As previously mentioned, the proper interpretation to give to the claims is the only issue before us on review and, therefore, any further infringement analysis

is unnecessary. Accordingly, we affirm the Master's finding of infringement.

C. The Reed Patent

Inequitable Conduct

We have reviewed JJO's argument that the Reed patent is unenforceable based on 3M's intentional misrepresentation and omission of material facts in the Livermore and Racine affidavits submitted to overcome a PTO obviousness rejection. We have also reviewed the Master's extensive findings on this issue.

Inequitable conduct requires both a material misrepresentation or omission and an intent to mislead. See Greenwood v. Hattori Seiko Co., 900 F.2d 238, 241-42, 14 USPQ2d 1474, 1476 (Fed.Cir.1990). The Master, finding that JJO failed to prove either, determined that there was no inequitable conduct and that the patent is enforceable. JJO has failed to convince us that the Master abused her discretion on this issue.

D. Damages

The issue of the amount of damages, where the damage award is fixed by the district court, is a question of fact and reviewed under the clearly erroneous standard. SmithKline Diagnostics, Inc. v. Helena Lab., Corp., 926 F.2d 1161, 1164, 17 USPQ2d 1922, 1925 (Fed.Cir.1991); 1 Steven A. Childress & Martha S. Davis, Federal Standards of Review § 2.22 (2d ed. 1992) (all circuits agree that the clearly erroneous rule applies to determinations of damages by the district court). However, certain subsidiary decisions underlying a damage theory (such as choosing between reasonable alternative accounting methods for determining profit margin or adopting a reasonable way to determine the number of infringing units) are discretionary with the court and, of course, are reviewed under the abuse of discretion standard. Id.

1. Lost Profits Based On Lost Sales

To recover lost profits as actual damages, a patent holder must demonstrate that there was a reasonable probability that, but for the infringement, it would have made the infringer's sales. State Indus., Inc. v. Mor-Flo Indus., Inc., 883 F.2d 1573, 1577, 12 USPQ2d 1026, 1028 (Fed.Cir.1989), cert. denied, 493 U.S. 1022, 110 S.Ct. 725, 107 L.Ed.2d 744 (1990). However, it is not necessary for the patent holder to negate all possibilities that a purchaser might have bought a different product or might have foregone the purchase altogether. Id. One way to prove lost profits is for the patent holder to prove (1) demand for the patented product, (2) absence of acceptable noninfringing substitutes, (3) its manufacturing and marketing capability to exploit the demand, and (4) the amount of profit it would have made. Id. The existence of a noninfringing substitute is a question of fact, reviewable under the clearly erroneous standard. Radio Steel & Mfg. Co. v. MTD Prods., Inc., 788 F.2d 1554, 1556, 229 USPQ 431, 432 (Fed.Cir.1986).

JJO argues that the Master's award of lost profits for the Reed and Garwood inventions is based on an erroneous finding that there were no acceptable non-infringing substitutes available. JJO argues that it could have purchased (for

resale) non-infringing alternatives to its Red Label and Improved Red Label products from Bayer in Germany because Bayer had a license under the Garwood and Reed patents 10 and had supplied JJO with similar type tapes in the past.

The Master's findings indicate that although Bayer may have been entitled to manufacture casting tapes under the Garwood and Reed patents it was unable to manufacture commercially acceptable casting tapes. Specifically, the Master found:

From the beginning of the period of infringement in September, 1985 through late 1990, Bayer was unable to manufacture casting tape which met JJO's product standards. JJO's own testing shows that Bayer-made product was unacceptable to JJO. Bayer did not supply JJO

with commercially acceptable casting tape until several weeks before the trial, and that was admittedly done only for purposes of this litigation. There is no evidence in the record suggesting that JJO could have actually purchased a competitive casting tape from Bayer during the infringement period.

This finding is supported by JJO's own documents and witnesses.

JJO argues that the Master failed to consider all market influences when determining lost profits or reasonable royalty damages and alleges that she ignored the fact that JJO could have taught Bayer how to make acceptable products or given Bayer its machinery and personnel to enable it to make acceptable products. Had the Master considered this fact, JJO argues, she would have found that a non-infringing alternative was available.

Based on the record, we are not convinced that the Master failed to consider this argument. The Master expressly recognized that JJO had "attempted to show that it would have maintained its own sales by importing licensed product from Bayer in Germany." JJO had the opportunity to proffer convincing rebuttal evidence on noninfringing substitutes and failed to do so. Therefore, based on the record before us, we conclude that JJO failed to establish that the Master's finding that there were no acceptable noninfringing alternatives with respect to the Reed and Garwood inventions was clearly erroneous.

With respect to the Scholz patent, JJO argues that its Conformable (Blue Label) product with U-Thane resin is an acceptable, non-infringing substitute. We find the presentation of this argument to be frivolous. The only support for JJO's argument is its allegation that 3M failed to show that Blue Label with U-Thane was not a non-infringing substitute and, therefore, failed to carry its burden to show that no infringing alternative existed. However, there is no dispute that this issue was not considered at trial. In fact, JJO's brief expressly states that "Blue Label with U-Thane was never made part of this case." In light of these circumstances, JJO cannot expect this argument to be heard by this court when it was not raised at trial. Weinar v. Rollform Inc., 744 F.2d 797, 804, 223 USPQ 369, 372-73 (Fed.Cir.1984), cert. denied, 470 U.S. 1084, 105 S.Ct. 1844, 85 L.Ed.2d 143 (1985).

2. Lost Profits Based On Price Erosion

The Master also awarded 3M $28,923,219 in lost profits due to price erosion caused by JJO. The Master determined that 3M would have been able to increase its prices 2% per annum during the period of infringement if JJO had not been competing in the market. 11 JJO argues that there is "not a shred" of evidence in the record to support the 2% figure and that the Master should not have awarded these damages. We disagree.

The Master made several findings of fact indicating that, among other things, 3M

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and JJO engaged in vigorous price competition over equivalent products which caused a steady decline in the price of casting tape during the infringement period and 3M would have charged higher prices absent JJO's infringement. Although other companies also engaged in price competition, they had a small effect on the downward trend of prices because they offered inferior products and their market share continually declined over the course of the infringement period to the point where 3M and JJO together had approximately 85% of the market. The Master also found that 3M would have commanded 70-80% of the casting tape market with JJO gone and would have experienced little or no price competition from other competitors.

In addition, 3M's witnesses testified and presented documents to show that 3M would have raised prices approximately 4% per year to match the rate of inflation. 3M compared these figures with JJO's practice of raising prices 4%

per year in the plaster casting market where JJO held a similar market share and had no patent protection.

JJO argued that there would have been zero inflation on synthetic casting tapes. After considering the evidence, the Master concluded that if JJO were not in the market, 3M could have and would have taken annual price increases of 2%. Although damages may not be based on speculation, they need not be proved with unerring precision either. Bio-Rad Lab., Inc. v. Nicolet Inst. Corp., 739 F.2d 604, 616, 222 USPQ 654, 664 (Fed.Cir.), cert. denied, 469 U.S. 1038, 105 S.Ct. 516, 83 L.Ed.2d 405 (1984). The Master is not restricted from choosing a figure other than that advocated by either party and may substitute an intermediate figure as a matter of judgment from all the evidence. SmithKline, 926 F.2d at 1168, 17 USPQ2d at 1927. We find that the Master's decision to award the 2% increment rate based on all the evidence was not clearly erroneous.

3. Computational Errors

JJO alleges that the Master committed some computational errors which the district court failed to correct. Although an arithmetical error would be a clear error of fact, JJO has failed to convince us that such errors were made.

JJO's argument relies on FF-391 wherein the Master, comparing the cost analyses presented by JJO's and 3M's respective experts, found that under the circumstances of this case "Hoffman's [JJO's expert] cost analysis is accurate and creditable." (Emphasis ours.) In the same finding, the Master says, "Production of the additional units claimed by 3M would have resulted in increased costs in an amount $10 million over and above those costs estimated by 3M." (Emphasis ours.) JJO then cites to a chart prepared by Mr. Hoffman, entitled "Impact Of Incremental Costs Errors" (Def.Ex. 844), which indicates that, based on an increased volume of 10,226,245 units, 3M's increased costs would amount to $13,074,334 over and above the costs estimated by 3M. Based on this information, JJO contends that the Master misread the chart and erroneously took the Unit Volume (i.e., 10,226,245 units) in place of the Magnitude of Error in dollars (i.e., $13,074,334 in additional production costs) in arriving at the $10 million figure.

JJO's argument is based on the presumption that there is no other explanation to explain how the Master arrived at the $10 million figure. However, using a different method of calculation, 3M's expert, Mr. Troxel, estimated that additional production costs would amount to $7,272,908. Although the Master credited JJO's cost analysis, she also found that "[b]oth methods present an acceptable basis for estimating variable costs" although "3M has understated the amount of increased costs it would have incurred by its increased sales." As previously stated, the Master may choose a figure other than that advocated by either party. Id. Here, as she did in determining the price erosion percentage, the Master split the difference between the two estimates advocated by JJO's and 3M's experts rounding it off to $10 million. We hold that the Master's decision to adjust the two estimates provided by 3M and JJO to reflect her assessment

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of what the increased production costs would be is not clearly erroneous.

E. Willful Infringement of the Reed and Scholz Patents

The question of whether infringement is willful is one of fact and, as such, is reviewable under the clearly erroneous standard. Ryco, Inc. v. Ag-Bag Corp., 857 F.2d 1418, 1428, 8 USPQ2d 1323, 1334 (Fed.Cir.1988); Bott v. Four Star Corp., 807 F.2d 1567, 1572, 1 USPQ2d 1210, 1213 (Fed.Cir.1986). JJO presents three primary arguments with respect to this issue. First, JJO alleges that the Master applied an erroneous legal standard in determining that JJO willfully infringed the Scholz and Reed patents. Second, with respect to both the Scholz and Reed patents, JJO argues

that it had a reasonable basis (i.e., the opinion of its in-house counsel) to believe that the patents were invalid and unenforceable. Finally, with respect to the Scholz patent, JJO argues that the Master erroneously based her willfulness determination on JJO's misappropriation of 3M's trade secrets.

1. The Proper Legal Standard

JJO's first argument is not supported by the record. The Master accurately laid out the correct legal standard expressly quoting this court's language in Ryco, Inc.:

A court must look at whether "under all the circumstances, a reasonable person would prudently conduct himself with any confidence that a court might hold the patent invalid or not infringed."

More importantly, we are convinced by the Master's opinion and findings of fact that she considered all the circumstances in this case before arriving at her decision. JJO's argument focuses on what the Master says in one sentence 12 instead of on the totality of what the Master actually did as evidenced by her analysis and detailed list of findings. Finally, the Master's findings were reviewed and considered, in light of JJO's argument, by the district court which then adopted the Master's conclusion. Based on our review of the record, we are not convinced that the Master or the district court applied an improper standard of review.

2. Reliability of JJO's In-House Opinion

It is well settled that a potential infringer having actual notice of another's patent has an affirmative duty of due care that normally requires the potential infringer to obtain competent legal advice before infringing or continuing to infringe. Ryco, 857 F.2d at 1428, 8 USPQ2d at 1332. However, legal advice is only one factor to be considered, and an opinion of counsel does not guarantee against a finding of willfulness. Id.; see Underwater Devices, Inc. v. Morrison-Knudsen, 717 F.2d 1380, 1390, 219 USPQ 569, 576 (Fed.Cir.1983); Datascope, 879 F.2d at 828, 11 USPQ2d at 1327. The emphasis here must be on "competent" legal advice. JJO obtained legal advice from its in-house counsel, Michael Tatlow, in the form of an oral opinion. As this court has recognized, oral opinions are not favored. Shiley, Inc. v. Bentley Lab., Inc., 601 F.Supp. 964, 968, 225 USPQ 1013, 1016 (C.D.Cal.1985), aff'd., 794 F.2d 1561, 230 USPQ 112 (Fed.Cir.1986); Bott, 807 F.2d at 1572, 1 USPQ2d at 1213. Such opinions carry less weight, for example, because they have to be proved perhaps years after the event, based only on testimony which may be affected by faded memories and the forces of contemporaneous litigation.

Furthermore, the Master determined that JJO had no reasonable basis to rely on Tatlow's oral opinion because, at a minimum, it was not objective. Tatlow opined that (1) the Reed patent was invalid

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because the process of heat setting without tension had been known and practiced by Carolina Narrows Fabric (CNF), JJO's fabric supplier, for years and (2) the technique of heat setting without tension was taught in U.S. Patent No. 2,633,428, issued to Klug in March, 1953 (the Klug patent). However, Tatlow obtained his information that heat setting without tension had been practiced for years, not from an independent expert, but from the president of CNF who had a stake in the outcome.

The Master further found that JJO knew the information was false for at least two reasons. First, JJO knew CNF was unable to produce an extensible fabric without frayed ends because JJO had repeatedly asked CNF to produce such a fabric and had documented CNF's inability to do so. Second, three months after 3M's Scotchcast 2 came on the market, it was JJO's scientist who discovered its secret and provided this information to CNF.

Similarly, CNF had provided the Klug patent to Tatlow with an explanation that it taught heat setting without tension. However,

the Master found that the patent is directed toward woven glass fabrics, and the continuous nature of the process shows that the fabric is under sufficient tension to distort knit fiberglass loops. The Master also found that nothing in Klug suggests that the process will produce an extensible heat set knit fiberglass fabric and that JJO did not seek an opinion from outside patent counsel evaluating the effect of Klug on Reed before deciding to infringe the Reed patent.

In January, 1987, Tatlow also informed the management of JJO that the Reed patent was unenforceable because 3M's Livermore and Racine affidavits were filed with the intent to mislead the PTO with false information. JJO's argument that it had a reasonable basis to believe that the Racine and Livermore affidavits contained fraudulent information was also found to be unreasonable by the Master. With respect to the Racine affidavit, JJO knew that the substance of the commercial success information was true because JJO was copying the Reed invention in its Improved Red Label product, which was also experiencing commercial success. With respect to the Livermore affidavit, the Master found that JJO had no reasonable basis to dispute the substance of the affidavit that the standard process in the prior art for producing fiberglass substrates was through heat setting under tension.

As the Master indicated, "JJO chose to ignore facts long in its possession, and instead rely on facially unreasonable claims from its fabric supplier, to justify infringement." As this court warned in Ryco, "[a]n alleged infringer who intentionally blinds himself to the facts and law, continues to infringe, and employs the judicial process with no solidly based expectation of success, can hardly be surprised when his infringement is found to have been willful." 857 F.2d at 1429, 8 USPQ2d at 1332.

3. Reliance on JJO's Trade Secret Misappropriation

JJO seems to imply that the Master erroneously based her willful infringement finding solely on JJO's trade secret theft which occurred before the issuance of the Scholz patent. This argument is not supported by the record.

Although the Master based her willful infringement finding on JJO's conduct surrounding its misappropriation of 3M's trade secrets, her reliance thereon was just one of the criteria used to make her determination. Such considerations are completely proper. When determining whether infringing conduct warrants a finding of willfulness the court must examine the totality of the circumstances of the case. Kaufman Co. v. Lantech, Inc., 807 F.2d 970, 978-79, 1 USPQ2d 1202, 1208 (Fed.Cir.1986); Kloster Speedsteel AB v. Crucible, Inc., 793 F.2d 1565, 1579, 230 USPQ 81, 90 (Fed.Cir.1986), cert. denied, 479 U.S. 1034, 107 S.Ct. 882, 93 L.Ed.2d 836 (1987). In addition, although willfulness is generally based on conduct that occurred after a patent issued, pre-patent conduct may also be used to support a finding of willfulness. See Kaufman, 807 F.2d at 978-79, 1 USPQ2d at 1208.

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As the Master found, Tatlow was involved with the misappropriation of the 3M trade secrets and was copied on the internal JJO memorandum which disclosed that JJO researchers had figured out the 3M trade secret in the samples stolen by Stegora. He also prepared and prosecuted JJO's patent application on the slippery resin product which was based on the misappropriated 3M technology. The fact that JJO, with the help of its in-house attorney, Tatlow, would attempt to patent the stolen technology makes Tatlow's opinion suspect. It is doubtful that Tatlow could have the requisite impartiality to objectively evaluate the Scholz patent. H.B. Fuller Co. v. National Starch and Chem. Corp., 689 F.Supp. 923, 952, 7 USPQ2d 1753, 1775-76 (D.Minn.1988). Furthermore, the Master found that the positions Tatlow allegedly adopted in his oral opinion regarding the tacky prior art with respect to the Scholz patent were

inconsistent with positions he took on that art in prosecuting the JJO application.

Finally, many other findings support the Master's willfulness determination including JJO's full appreciation of the commercial significance of the Scholz patent and the technological improvement of its described inventions over the prior art, Spindelfabrik Suessen-Schurr Stahlecker & Grill, GmbH v. Schubert & Salzer Maschinenfabrik Aktiengesellschaft, 829 F.2d 1075, 1083, 4 USPQ2d 1044, 1050-51 (Fed.Cir.1987), cert. denied, 484 U.S. 1063, 108 S.Ct. 1022, 98 L.Ed.2d 987 (1988), JJO's knowledge that it had wrongfully acquired and misappropriated the Scholz invention and that its products were derived from 3M's technology, Colgate-Palmolive Co. v. Carter Prods., 230 F.2d 855, 866, 108 USPQ 383, 391 (4th Cir.), cert. denied, 352 U.S. 843, 77 S.Ct. 43, 1 L.Ed.2d 59 (1956), JJO's pattern of copying 3M innovations in each synthetic casting product in order to remain competitive in the market, State Indus., 883 F.2d at 1582, 12 USPQ2d at 1032, and the intense business and technical rivalry between JJO and 3M. In such circumstances due care may require the opinion of outside counsel. 13 H.B. Fuller, 689 F.Supp. at 952, 7 USPQ2d at 1775-76.

The Master's decision that JJO willfully infringed the Reed and Scholz patents without any good faith belief that the patents were either invalid or unenforceable is supported by the record. After reviewing all of JJO's arguments, we are left unconvinced that the Master's willfulness determination was clearly erroneous. Likewise, JJO has failed to convince us that the Master abused her discretion in doubling the damages.

III.

CONCLUSION

Accordingly, the judgment of the district court is affirmed.

AFFIRMED.

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1 JJO acknowledges this purpose in its brief when it states "[i]ndeed, the entire purpose and only purpose of the invention is to render the surface of the casting tape slippery so as to facilitate smoothing during application."

2 The KCOF value is a function of at least two variables--the resin and the surface of the scrim--meaning that the KCOF can be affected by changing the tackiness of the surface (changing the resin) or the roughness of the surface (changing the scrim). This finding is supported by the specification and the testimony of William Van Santen, JJO's expert witness called to testify on the inequitable conduct issue.

3 3M had conducted KCOF tests on two commercial products, Scotchflex XF and JJO's Red Label product, and found that they had surface KCOF values of 1.25 and 1.47, respectively. 3M did not report this data to the PTO and had represented that the nearest prior art KCOF was 1.76. JJO argued that 3M's failure to report the test data (i.e., the KCOF values of 1.25 and 1.47) constituted inequitable conduct rendering the Scholz patent unenforceable.

4 We also note that JJO's argument incorrectly implies that the low KCOF limitation is equivalent to finding that the casting tape is lubricated. A low KCOF under about 1.2 is a limitation in the claims, and is therefore a necessary condition of both infringement and anticipation. But it is not a sufficient condition of either. The product must also be lubricated which, contrary to the way JJO would have us interpret the claims, is not the same as a low KCOF which does not, in and of itself, establish that the product is lubricated.

5 The amount of silicone measured in one prior art product known as UltraCast and in 3M's prior art commercial products, Scotchflex XF and Scotchcast Reinforcing Strip, amounts to 0.7% and 0.18% of the resin, respectively. The amount of silicone in the JJO products was even less.

6 The rolls of tape must be packaged under controlled conditions. If the temperature is not controlled and the rolls are exposed to too much

heat, the exposed resin will thin out and puddle at one end of the roll.

7 The record reveals that 3M issued a subpoena requesting additional samples, but that JJO refused to provide any.

8 The Lightcast products produced a fiberglass cast using a resin that had to be cured using a cumbersome and expensive ultraviolet lamp. In addition, the curing phase took a long time, and the resin had an unpleasant odor.

9 We note that JJO included two sketches in its brief labeled PX-57 and PX-68 which JJO misrepresented as 3M's and JJO's respective fabrics. However, upon review of the record we find that these are not the true exhibits used at trial. PX-57 and PX-68 were, in reality, photographs magnifying the respective fabrics. After carefully comparing the actual photographic exhibits with the sketches, we find that JJO's sketches, especially PX-68 which exaggerates the relative size of the "openings" formed by the loops, misrepresents what is shown in the actual exhibits. JJO failed to inform this court that the sketches were not the actual exhibits or to explain, for example, that they were JJO's "reproduction" or "interpretation" of the photographs. Furthermore, when the misleading sketches were brought to the court's attention in respondent's brief, JJO failed to provide any explanation as to why they were not properly identified, let alone mislabeled.

10 The Master's findings indicate that Bayer may "possibly" have had a license under the Reed patent. However, for the purposes of this opinion we will assume that JJO's representation of this fact is correct.

11 Based on the 2% figure, 3M's lost profit would have been $38,723,219. The Master, however, subtracted $9.8 million which she determined would be the market contraction that would result from 3M's price increases, arriving at the final figure of $28,923,219.

12 JJO argues that the emphasized language indicates that the Master applied the wrong standard of review in determining willfulness:

"Here, JJO had no reason to be confident that a court would hold the Reed patent invalid, or rule that JJO did not infringe." (Emphasis added.)

The district court found that the "paraphrased" language, which followed the Master's recitation of the correct standard, was within the spirit of Ryco and did not place an erroneously high burden of proof on JJO.

13 JJO argues that the Master's finding of willfulness was erroneous because JJO did obtain an outside opinion. However, the opinion obtained was from JJO's outside trial counsel in June 1988--twenty-one months after the Reed patent issued and thirteen months after the Scholz patent issued. The Master found that this opinion was a case analysis prepared by outside counsel representing JJO in this lawsuit and as such is inherently suspect. The case analysis states that if the Reed and Scholz patents are valid, then JJO infringes. With respect to the invalidity of the Reed patent, the Master found that the case analysis relied exclusively on CNF's unsubstantiated claims of prior use; and, the fact that JJO failed to inform outside counsel of the facts in its possession (i.e., that CNF did not previously practice the invention) limits JJO's ability to rely on the case analysis.